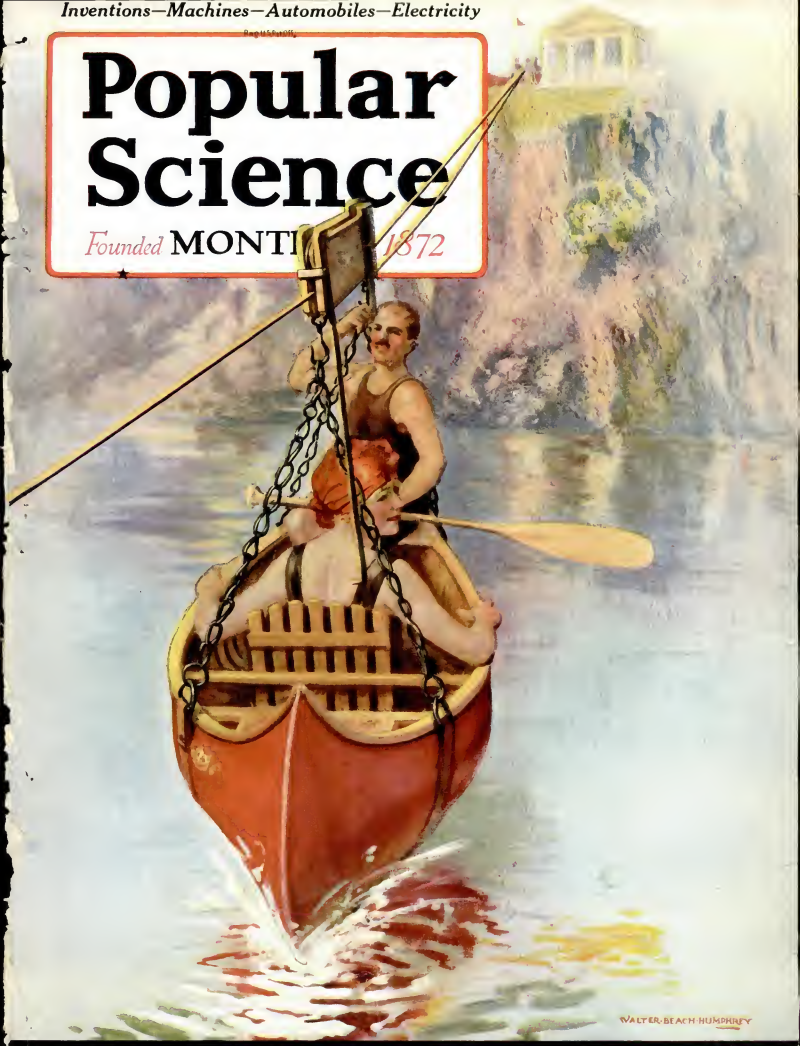
Inventions—Machines—Automobiles—Electricity

Popular Science

Founded MONTH 1872



JUNE

200 live practical articles

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Men! Look!

3 Silk Knit Ties $3.49 FOR ALL 3

HERE IS A WONDERFUL BARGAIN.—An amazing offer. Three beautiful all silk knitted ties in the very newest right-up-to-the minute New York styles for only $3.49 for all three. See what retail stores charge for ONE pure silk knitted tie of this quality. Every thread of each tie is 100% pure long-strand ever-wearing silk, not NEAR silk, or FIBRE silk, or JAP silk, or any imitation, but absolutely CHEMICALLY TESTED 100% PURE THREAD SILK. Knitted in the latest artistic weave, including the new pineapple stitch—all this season's most popular and wanted effects. The very fashionable small knot that the best dressed young men in America will wear this summer. Easy-slip neckbands—no binding or bulging your collar. Especially intended to be worn with the smart low collars young men now favor. These ties will be the pride of your wardrobe and make your friends ask you where you got them. An extraordinary bargain—these three all silk knitted ties for only $3.49.

SEND NO MONEY

Don't send a penny now. Don't take our word for the beauty and quality of these all silk knitted ties. Simply send the coupon or a letter. See the ties. If not better than you thought return them and you will not be out one penny. When the three ties arrive, you simply pay the postman $3.49 plus the few pennies postage. Examine the ties. Compare them. If you are not more than delighted with your bargain, send the ties back to us at our expense and get your money back at once. You be the judge. Mail the coupon or letter now.

SILK-KNIT TIE CO.,
Dept. 26, 42 East 26th Street, New York City

SILK-KNIT TIE CO.,
Dept. 26,
42 East 26th St., New York

Please send me at once the three pure all silk knitted ties illustrated and described on this page. I will pay the postman $3.49 plus postage, but if I am not satisfied I will mail the ties back at your expense within five days and you are to refund my money at once.

Name.....

Address.....

.....

The Victrola is to music what gold is to commerce

—the one final standard of value. When, in selecting an instrument for your home, you choose the Victrola and Victor records, the whole world confirms your judgment.

Victor records and Victor instruments are one. Each is made to operate with the other and no other combination can be made to produce as satisfactory results.

Victrolas $25 to $1500. New Victor records demonstrated at all dealers in Victor products on the 1st of each month.

Victor Talking Machine Co.

Camden, N. J.

"HIS MASTER'S VOICE"

This trademark and the trademarked word "Victrola" identify all our products. Look under the lid! Look on the label!

VICTOR TALKING MACHINE CO.
Camden, N. J.

Popular Science Monthly

JUNE, 1921
Volume 98-No. 6

Important to Readers

Owing to the paper shortage, the number of printed copies of POPULAR SCIENCE MONTHLY is limited. To insure getting your magazine regularly, you should place a standing order with your newsdealer, or send us your yearly subscription of $3.00.

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AERONAUTICS

FOR THE FARMER

(Continued on page 4)

POPULAR SCIENCE MONTHLY is issued monthly. Yearly subscription in the United States, $3.00. Canada, $3.50. Foreign, $4.00. Single copy, 25 cents. Advertising rates on application. Forms close the twentieth of the second month preceding date of publication. Entered as second-class matter Dec. 28, 1915, at the Post Office at New York under the act of March 3, 1879. Entered as second-class matter at the Post Office Department, Canada.

H. J. Fisher, President; R. C. Wilson, Vice-President; O. B. Capen, Secretary and Treasurer.

Modern Publishing Company
225 West Thirty-ninth St. New York City

Was $5.00

FAMOUS ROTH MEMORY COURSE

Now $2.97

300,000 Roth Memory Courses have been sold at $5 each. If you act at once you can get one for only $2.97! For a limited time you can save over $2 on this famous course that you have heard so much about!

Special arrangements in the matter of royalties, printing plates, paper, cover stock, etc., make this limited-time offer possible. This is your chance to put the Roth Memory Course to the test. You have heard a lot about it and what it has done for others. Now, at a real saving, you can prove what it will mean to you.

After 5 days examination, if you are not absolutely convinced that the Roth Course can actually improve your memory, mail it back and you will not be out one cent. Send no money with the coupon below!

SEND NO MONEY

300,000 men and women all over the world—most of them doubters or scoffers—have given the Roth Memory Course the acid test. Even tho they doubted, the test involved no risk—and they made it.

And now these same thousands are packing our files with letters like the few shown here. By the score they write us how the Roth Course *improved their memories in one single evening!*—how they now have the kind of memory they have always wanted, the kind that grips facts, figures, and faces and never lets go.

You risk nothing in proving to yourself that you can have a better memory than you ever dreamed of! Let us convince you that you can improve your memory in one evening! Send No Money. This coupon brings the complete famous Roth Memory Course right to your home, where $2.97 to the postman will make it your property. Test it 5 days and then if you believe that the 300,000 others did wrong in retaining it, send yours back and the $2.97 will immediately be refunded. Act now—convince yourself—at over $2 saving—of the value to *you* of the Roth Memory Course. Mail this coupon—without money—today!

David M. Roth

Mr. Roth has time after time at dinners and lectures asked fifty or sixty men he has never met to tell him their names, businesses and telephone numbers and then after turning his back while they changed seats has picked each one out by name, told him his telephone number and business connection. And yet, when Mr. Roth first determined to make his power memory good, he couldn't remember a man's name 20 seconds. To 300,000 people Mr. Roth has proven that his system will improve anyone's memory in one evening.

Improve Your Memory in One Evening

Has it ever occurred to you that the experience you gain every day of your life is like gold? Does your mind *retain* this gold? If you have not a good memory and cannot recall instantly facts and figures that you learned years ago you cannot make your experience count.

Memory and good judgment go hand in hand. Our judgment is simply the conclusions we draw from our experience, and our experience is only the sum total of what we remember. When memory fails, experience, the thing we all value most highly, is worthless.

Is your memory as good as you'd like it to be? Can you instantly remember names and faces, telephone numbers, speeches and notes? Can you at once recall business details, selling points, legal points, statistics, figures, conversations? Do you remember what you read, see and hear?

Mr. Roth's system, which he has developed through years of study and which he has taught in class to thousands of business men and others throughout the country in person, is so easy that a twelve-year-old child can learn it, and it is more real fun than any game you play solely for pleasure.

You get results in the first few moments. And a single evening spent on the first lesson will absolutely double your memory power—and may do even more, just as it has for thousands of others.

Just think what this will mean to you—to have twice as good a memory—to have a memory that will enable you instantly to recall at will facts, figures, faces, addresses, phone numbers, selling points, data and all kinds of mental pictures with less than one-hundredth of the effort you now spend in trying to remember without success. Don't go about the world on "memory crutches"—putting slips of paper in your hat—tying strings on your fingers—forever scribbling in a note-book. Why have a memory that is an embarrassment—an obstruction to your success?

Let us prove to you—at our risk—that the Roth Course will do as much for your memory as it has for so many thousands of others. This special offer brings you the complete regular and genuine $5 Roth Memory Course for only $2.97. Send no money — but mail this coupon at once while this special offer is open! Mail it to-day!

Independent Corporation
Dept. R-776,
319 Sixth Avenue, New York

A Few of Thousands of Other Letters

"I was surprised to see how I improved my memory the first evening."
M. J. Blackenshop,
Mohawk, W. Va.

"I am amazed at my increased memory powers since studying the first lesson."
Anne S. Leach,
Wytheville, Va.

"So simple and fascinating that it is play to study it."
E. W. Buckingham,
M.D., Norfolk, Va.

"The system works like magic."
Ralph D. Stoddard,
Cleveland, O.

INDEPENDENT CORPORATION
Dept. R-776
319 Sixth Avenue, New York

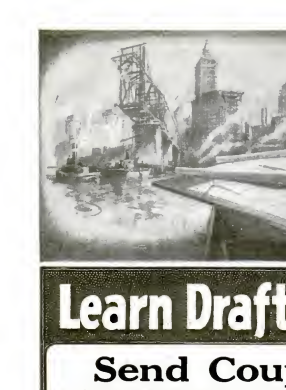
Send me the regular $5 Roth Memory Course in 7 complete lessons. I will pay the postman only $2.97 on arrival. If I am not satisfied with it I have the privilege of returning it to you after a 5-day trial. It is, of course, understood that you are at once to refund my money ($2.97) if I return the course.

Name.....

Street.....

City.....

State.....



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INDUSTRIAL PROGRESS

MEDICINE AND SURGERY

MISCELLANY

MOTOR VEHICLES AND ACCESSORIES

(*Continued on page 6*)

Was $100

Before the War

Now $64

In these days when the cost of many things is higher than before the war, it is a distinct contribution to business-economy to offer through more direct selling methods such a great and decided saving on so popular a typewriter as the Oliver.

SAVE $36

FREE TRIAL

Easy Payments

Over 900,000 Sold

A Finer Typewriter at a Fair Price

Send No Money!

No money in advance. Not a cent! Simply make your request via the coupon below if you want this brand new Oliver Typewriter for five days free trial in your own home or office. Use this Oliver for five days as if it were your own. Type all your letters or any other work with it. Put it to every conceivable test. Compare it with any $100 typewriter on the market. Compare it for simplicity of construction. For beauty of finish. For ease of operation. For speed. For neatness of work. Then if after 5 days free trial you do not wish to keep the typewriter for any reason whatsoever, simply send it back to us and you won't be out one cent for the free trial. If, on the other hand, you decide that it is the finest typewriter, and you wish to keep it, then pay us at the easy rate of only $4 a month. This is the open, free trial offer we make to you on the Oliver to let you see for yourself that if any typewriter is worth $100 it is this splendid, speedy Oliver No. 9, our latest model and finest we ever built.

Famous Users of the Oliver

- Columbia Graphophone Co.
- Otis Elevator Company
- National City Bank of N. Y.
- Boston Elevated Railway
- Hart, Schaffner & Marx
- U. S. Steel Corporation
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- American Bridge Company
- National Cloak & Suit Co.

Save $36

For $64 you can now obtain the identical Oliver Typewriter formerly priced at $100. We are able to save you nearly half because of our radically new and economical method of distribution. During the war we learned many lessons We found that it was unnecessary to have such a vast number of traveling salesmen and so many expensive branch houses throughout the country. We were able to discontinue many other superfluous sales methods. Result—we can afford to sell at $64 the very same Oliver formerly priced at $100.

Mail the Coupon Now

Check the coupon to get the Oliver for five days free trial in your own home. If you decide to keep the typewriter you can pay for it on terms so easy that you won't miss the money—only $4 a month. If you prefer to have further information before ordering, fill in the coupon for our free catalog. Clip the coupon now and mail at once.

Canadian Price, $82

The OLIVER Typewriter Company

1106 Oliver Typewriter Bldg., Chicago, Ill.

THE OLIVER TYPEWRITER COMPANY
1106 Oliver Typewriter Bldg., Chicago, Ill.

☐ Ship me a new Oliver Nine for five days free inspection. If I keep it, I will pay $64 at the rate of $4 per month. The title to remain in you until fully paid for.

My shipping point is .....
This does not place me under any obligation to buy. If I choose to return the Oliver, I will ship it back at your expense at the end of five days.

☐ Do not send a machine until I order it. Mail me your book—"The High Cost of Typewriters—The Reason and the Remedy," your de luxe catalog and further information.

Name .....

Street Address .....

City ..... State .....

Occupation or Business .....

CONTENTS—*Continued*

NATURAL SCIENCE

PICTORIAL PAGES

SPORTS AND PASTIMES

SHIPS AND SHIPBUILDING

PRACTICAL WORKERS

These Are the Hours that Count

MOST of our time is mortgaged to work, meals and sleep. But the hours after supper are *yours,* and your whole future depends on how you spend them. You can fritter them away on profitless pleasure, or you can make those hours bring you position, power, *real success* in life.

Thousands of splendid, good-paying positions are waiting in every field of work for men *trained to fill them.* There's a big job waiting for *you*—in your present work, or any line you choose. Get ready for it! You can do it without losing a minute from work, or a wink of sleep, without hurrying a single meal, and with plenty of time left for recreation. You can do it in one hour after supper each night, right at home, through the International Correspondence School.

Yes—you can win success in an hour a day. Hundreds of thousands have proved it. The designer of the Packard "Twin-Six" and hundreds of other Engineers climbed to success through I. C. S. help. The builder of the great Equitable Building, and hundreds of Architects and Contractors won their way to the top through I. C. S. spare-time study. Many of this country's foremost Advertising and Sales Managers prepared for their present positions in spare hours under I. C. S. instruction.

For 29 years men in offices, stores, shops, factories, mines, railroads—in every line of technical and commercial work—have been winning promotion and increased salaries through the I. C. S. Over 130,000 men are getting ready *right now* in the I. C. S. way for the bigger jobs ahead.

No matter where you live, the I. C. S. will come to *you.* No matter what your handicaps, or how small your means, we have a plan to meet your circumstances. No matter how *limited* your previous education, the simply written, wonderfully illustrated I. C. S. textbooks make it easy to learn. No matter what career you may choose, some one of the 280 I. C. S. Courses will surely suit your needs.

When everything has been made easy for you—when one hour a day spent with the I. C. S. in the quiet of your own home will bring you a bigger income, more comforts, more pleasures, all that success means—can you afford to let another single priceless hour of spare time go to waste? Make your start right now! This is all we ask: Without cost, without obligating yourself in any way, put it up to us to prove how we can help you. Just mark and mail this coupon.

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BOX 7625-B SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

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☐ Electric Lighting and Rwys.	☐ ADVERTISING
☐ Electric Wiring	☐ Window Trimmer
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☐ ARCHITECT	☐ GOOD ENGLISH
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☐ Structural Engineer	☐ AUTOMOBILES
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☐ CHEMIST	☐ Poultry Raising ☐ Teacher
☐ Pharmacy	☐ Banking

Write name and address here

Name_____

Present Occupation_____ Business Address_____ 7-1-21

Street and No._____

City_____ State_____

Canadians may send this coupon to International Correspondence Schools Canadian, Limited, Montreal, Canada

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HERE READERS AND ADVERTISERS MEET TO TRANSACT BUSINESS

Rate 25 Cents a Word. Advertisements intended for the August issue should be received by June 1st

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AUTO motors supplies: Buick—Michigan—Stoddard-Dayton—E. M. F. Cadillac—Overland—Continental and Buda Motors. All types, $50.00 each and up. New Dixie Magneto $20.00. Splitdorf High Tension Magnetos $10.00. Kellogg Pumps $3.50. Auto-Lite generators, new $10.00. Air Guages $.65. Remy Ignition Coils, new $3.00. Electric and gas headlamps, coils, distributor beads, air compressors, etc. Write for catalog. Motor Sales Dept. 14, West End, Pittsburgh, Pennsylvania.

AUTOMOBILE Parts for all cars—50% off manufacturers' list price. Pistons, connecting rods, cam shafts, crank shafts, cylinders, axles and gears. Our new catalogue and Used Parts Bulletin now ready. Write for it to-day. Service and satisfaction guaranteed. Auto Parts Company, 4108 Olive Street, St. Louis, Missouri.

PATENTS—Write for Free Illustrated Guide Book and Evidence of Conception Blank. Send model or sketch and description of invention for our opinion of its patentable nature. Highest references. Reasonable terms. Victor J. Evans & Company, 189 Ninth, Washington, D. C.

BLUEPRINTS—Automobile generator armatures. See ad under "Electrical." Charles Chittenden.

TIRE agents. Exclusive representatives to use and sell the new Mellinger Extra-Ply Tires. (No seconds.) Guarantee Bond 8000 Miles. Wholesale prices. Sample sections furnished. Mellinger Tire Co., 947 Oak, Kansas City, Missouri.

FREE to car owners, garagemen, mechanics. Send to-day for free copy, American Automobile Digest. Contains helpful, instructive information on overhauling, ignition, carburetors, storage batteries, wiring, adjusting, repairing, etc. Profusely illustrated. American Automobile Digest, 523 Butler Building, Cincinnati.

"MORPEP" Piston Rings will give new life to your motor. Save gas; avoid carbon troubles. Sample set of twelve, $2.00. Highest Quality. Money back if not satisfied. Midwest Specialties Company, Dept. W, 108 West Lake Street, Chicago, Illinois.

HOW to make automobile storage battery plates, $1.00 postpaid. H. Deckelman, 7118 Mashville Avenue, St. Louis, Missouri.

AUTOISTS "Saviorgas" easily made. Saves gas. Decarboniser, Recipe 10c coin. Hawthorne Company, Roslyn, Washington.

AUTOMOBILE soap three cents per pound. Write for free sample and particulars. Address "Formula," 135 East Tenth Street, Atlanta, Georgia.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

FORD ACCESSORIES

GREATEST sport in the world to run underslung Ford with "Fordspeed" classy body. Agents introductory offer. 4 speed transmissions; 16 valve overhead; speed bevel gears, carburetors, camshafts, crankshaft counterbalances. Illustrated Catalog. J. O. Ford Speed and Power Equipment Manufacturers, 250 West 54th, New York.

AVOID "turning turtle," leaving the road, locking over center. You can steer safely and easily out of ruts, through mud, sand, snow and on center-crowned roads, with a Sprague Worm Steering Gear. Same type as used on all larger cars. Prevents bumps in road from turning front wheels aside; gives you control of steering. Also absorbs shock, vibration and strain on arms and shoulders. Makes a far better and safer car. Easily, quickly installed; no holes to bore; outlasts car. Guaranteed to satisfy you. Write for particulars. Union Sales Co., Dept. 3, Omaha, Nebraska.

SPEEDSTER Fans. See "Red-I-Kut" ad, page 99.

EXCLUSIVE Agency, greatest Ford accessory ever invented. An automatic auxiliary air valve using the steam vapor from off the warm water in the radiator. Easily demonstrated and installed. Averages 25% saving gasoline and eliminates all carbon trouble. Money back guarantee. Write for particulars. Automatic Valve Engineering Company, 89 Clark, Brooklyn, New York.

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MODEL Makers send 20c for catalogue and set blue prints showing complete steam engines, boilers, parts, rods, tubing. Lathes quoted upon request. Model Makers Supply, 505 Fifth Avenue, New York.

MODEL aeroplanes that fly. Buy your complete outfit, scale drawings, fittings, compressed air motors and all best model aeroplane supplies from the Wading River Manufacturing Company. Established 1909. Our new fifty-two page catalog illustrates twenty-four latest models and designs. Send 10c for your copy. Wading River Manufacturing Company, 672B Broadway, Brooklyn, New York.

WE make working models for inventors and do experimental work, and carry a complete stock of brass gears and model supplies. Send for catalogue. The Pierce Model Works, Tinley Park, Illinois.

MODELS made and perfected, wood and metal. Honest work. Send blueprints or sketches for estimates. Geo. W. Walker Co., Lawrence, Long Island, New York.

DOES IT PAY?

A Few Answers To Your Question.

What an advertiser really wants to know before investing his money in any publication is—"What is it doing for others?" Here are a few timely tips from satisfied and successful advertisers who have found by experience that Popular Science Monthly pays:

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"Getting stronger every month" —Allen Mfg. Co.

"Eight to ten replies daily" —Irvin D. Wolf

"Your readers are buyers?" —W. H. Mahler

"Lead every other medium" —F. E. Wooten

"Stands second on our list" —Derr Schools

"40 to 60 inquiries per issue" —Motorcycle Parts Co.

"Brings home the bacon" —American Clock Co.

"149 inquiries in 4 months" —Air-Friction Carburetor

"Swamped with letters" —Meador & Company

"A top-notch puller" —Dearborn Adv. Agency

These are only a few of many similar comments taken from letters of advertisers who KNOW. If YOU are looking for big business at minimum cost, get your announcement in the next issue. You'll be glad to keep it going.

Classified Advertising Manager,

POPULAR SCIENCE MONTHLY,
225 West 39th Street,
New York City

ELECTRICAL

BLUEPRINTS—Electrical connections. Alternating and direct current motors, transformers, rheostats, controllers, compensators, automobile generator armatures. 10 samples A. C. 25c. Particulars free. Charles Chittenden, 83024 Matthews Avenue, Kansas City, Missouri.

ELECTRICIANS, Wiremen, Linemen, send your name and address for descriptive literature of our Modern Blue Print Chart Method of Electrical Wiring. Over 350 practical diagrams. Electrical Wiring Diagram Company, Box B173, Altoona, Pennsylvania.

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LET us be your factory! Write today. Logan Machine Company, 222 South Clinton Street, Chicago, Illinois.

WE do Metal Stamping, Gold, Silver, Nickel, Brass and Copper finishing. We will manufacture your article either on time or contract basis. If interested in large production write us. When on your die work you are always welcome at our diemaker's bench. Denning Mfg. Company, 1775-1777 East 87th Street, Cleveland, Ohio.

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YOU can add many dollars to your income by telling your fellow workmen about the matter I will explain to you upon request. H. O. Hartzell, Lancaster, Pennsylvania.

WANTED—Representatives in every Factory in the United States. Popular Science Monthly, 225 West 39th Street, New York.

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OUR "Modern" Duplicator reproduces 50 to 75 duplicate copies from each pen, pencil or typewritten letter, drawing, pricelist, or anything. Saves you money. Need one? Letter size $6.50. Booklet free. J. V. Durkin, Reeves Company, Mfgrs., Pittsburgh, Pennsylvania.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

MOTORCYCLES, BICYCLES, SUPPLIES

USED motorcycle parts half price. Schuck Cycle Company, 1922 Westlake, Seattle, Washington.

FOR sale—50 used bicycles, mud-guards and coaster brake, $15.00. $5.00 with order, balance C. O. D. Indian Motorcycle Agency, Hudson, New York.

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HANDMADE Toy Boats in 12 models. Charles B. Burr, Elkton, Maryland.

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DON'T buy formulas till you've secured Miller's valuable Descriptive Lists advertised in Agents' Column this magazine. Miller, Industria Chemist, Tampa, Florida.

SHOE Polish Formulas for sale. L. Allen, 566 Main Street, Brockton, Massachusetts.

FORMULAS—All Kinds. Catalogue free. Bestovall Laboratories, 4047 N. Whipple, Chicago.

FREE—Formula Catalog. Laboratories, Boylston Building, Chicago.

AVIATION

THE American School of Aviation announces a new correspondence course in Mechanics of Aviation. A thorough training in practical aeronautics. American School of Aviation, Dept. 1875, 3601 Michigan Avenue, Chicago.

INVENTORS desiring information write for our Free Illustrated Guide Book and Evidence of Conception Blank. Send model or sketch of invention for our opinion of its patentable nature. Highest references. Prompt service. Reasonable terms. Victor J. Evans & Company, 151 Ninth, Washington, D. C.

PROPELLERS for air propulsion. 5 ft. diameter $12. Other sizes in proportion. Hub mountings, bearings, sprockets and countershafts complete. Full scale blue prints for motorcycle-driven snow and ice sleds, 75c. Ford type, $1. Crawford Motor and Aeroplane Mfr., 142 South Rampart Street, New Orleans, Louisiana.

OUR New 1921 Large Aeronautical Supply Catalog now off the press. Late ideas and low prices. Send 15c. Our Ford and Motorcycle Airplane pamphlets describe the most complete little machines on the market. Propeller Catalog also. 4c each. Heath Airplane Company, Chicago.

"SPORTFORD" Tractor Biplane. Assemble your own from ready-made parts. Payments, $50 per month. Drawings and instructions for assembling plane, remodeling motor and flying included free. Aviation Engineering Company, Lawrence, Kansas.

FOR THE HOME

GRANDFATHER'S Clock Works $5.00. Build your own cases from our free instructions. Everybody wants a hall clock. You can make good profit building artistic clocks for your friends. We replace worn-out works in old clocks with works having chimes at money saving prices. Write for folder describing the most beautiful hall clock ever sold at $35.00. Clock Co., Nicetown, Pennsylvania.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

Quick-Action Advertisements continued on page 9

Quick-Action Advertisements continued from page 8

SAFETY RAZORS SHARPENED

BLADES re-sharpened—One edge 2c, double 3c. each. Work guaranteed. New method. F. Lohmen, Box 86, Duluth, Minnesota.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

AMERICAN MADE TOYS

MANUFACTURERS wanted for larger productions and Homeworkers on smaller scale for Metal Toys and Novelties. Toy Soldiers, Cannons, Cowboys, Indians, Buffalo Bills, Wild Animals, Whistles, Bird Whistles, Race Horses, Prizefighters, Religious Statuettes, Puzzles and hundreds of other Toys and Novelties. Hundred and more made complete per hour. No experience or tools needed. Bronze casting forms with complete outfit from $5.00 up. We are buyers of these goods all year, paying fixed prices. Contract orders placed with manufacturers. Exceptional high prices paid for painted goods. An enormous business offers industrious men an excellent opportunity to enter this field. An open market for these goods all over United States, Canada, and South America. Write us only if you mean business. Illustrated Catalogue and Booklet mailed free. Toy Soldier Manufacturing Company, Offices and Showrooms, 1696 Boston Road, New York.

STAMPING NAMES

MAKE $19.00 Hundred Stamping Names on Key checks. Send 25c for sample and instructions. PS Keytag Company, Cohoes, New York.

ROOTS—HERBS—PLANTS

HOP pillows. Buy two pounds extra choice flavored hops for $1.00 or $1.20 postpaid. J. N. Burton, Madison, New York.

MISCELLANEOUS

5 MASTER KEYS. Opens and tests thousands of different locks. Numerous experts endorse our keys as a precaution, convenience, necessity, and the most wonderful set of keys. They have satisfied thousands of purchasers, and will satisfy you too. Only $1.00 with Novel Key Chain. Master Key Company, 34 Manhattan Building, Milwaukee, Wisconsin.

IMMUNITY from infection. Use L-Wood Sanitary coverings for closet seats. Package containing 6, 15c postpaid. L-Wood, 460 Madison Avenue, Albany, New York.

DANDRUFF removed quickly, pleasantly, completely. Healthy scalp. For men, women, children. Wonderful benefit. Buy Kotalko at druggist's; or proof box mailed, 10 cents, postpaid. Kotalko Offices, BB-188, Station X, New York.

$700 Secures 150 acres with horses, 3 cows, machinery; fine opportunity for poultry raising, 100 acres tillage; 2000 cords wood; good house, 50-ft. barn; $1700, easy terms. Page 35 New Spring Catalog 1100 Bargains. Free. Strout Agency, 150BH Nassau Street, New York City.

SIX Oz. Genuine Cowhide Gentlemen belt with oxide buckle or without buckle. Best in America. Mailed to any address in the U. S. A. for one dollar; sizes from 40 to 50 for $1.25. Lindy Belt Company, 606 Commercial Place, New Orleans, Louisiana.

SAVE—Make—Money.—We make excellent Rubber Bands from your used inner tubes—60c pound boxed. Peerless, 8 Vanwagenen, Newark, New Jersey.

X-RAY—Wonderful instrument producing optical illusions. See what is apparently bones in fingers, etc. Price $1.00. Agents wanted. Frank Sears, 34 Globe Street, West Springfield, Massachusetts.

MODERN method of calculating. Eliminates half your work. Price $1.00. Berling Systems, Box 635, Indianapolis, Indiana.

CHICAGO Mail Address, Desk room $3.00 up per month. Great Lakes Letter Service, Room 404, 329 Plymouth Court.

DEUEL'S Swiss Ointment, Piles, Eczema, Serious Cuts, Burns. Clifford Deuel, Centreville, Michigan.

MONEY in manufacture of Alcohol, Essential Oils, Flavors. New Formula Book, $2.00. Hydrometers, $2.00. Circular free. Chemical P. & D. Company, Box 1682, Pittsburgh, Pennsylvania.

TELEGRAPHY

TELEGRAPHY—Morse and Wireless—taught at home in half usual time and at trifling cost. Omnigraph Automatic Transmitter will send, on Sounder or Buzzer, unlimited messages, any speed, just as expert operator would. Adopted by United States Government and used by leading Universities, Colleges, Technical and Telegraph Schools throughout United States. Catalog free. Omnigraph Mfg. Company, Dept. 42, 26 Cortlandt Street, New York.

TELEGRAPHY (both Morse and Wireless) and Railway Accounting taught quickly. Big salaries. Great opportunities. Oldest and largest school; established 46 years. All expenses low—can earn large part. Catalog free. Dodge's Institute, K Street, Valparaiso, Indiana.

STAMMERING

STAMMERERS: My simple and natural method will correct your impediments. Instruction individual. Samuel E. Robbins, 246 Huntington Avenue, Boston.

ST-TUT-T-T-TERING and Stammering cured at home. Instructive booklet free. Walter McDonnell, 59 Potomac Bank Building, Washington, D. C.

LETTER SPECIALISTS

FRANCIS writes the Best Sales Letters in the World. Floyd Delos Francis, Box 604, Atlantic City, New Jersey.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

ADVERTISING SERVICE

ONE Inch Advertisement in 100 Country Town Newspapers, $8.45. Ad-Guide free. Concordia Magazine, D. Water, York, Pennsylvania.

BATES literature and sales letters bring better business, say clients. Before advertising, get valuable free book, explaining all. Bates Better Way Advertising, Drawer 66, Springfield, Ohio.

ADVERTISING, newspapers, magazines, everywhere. We prepare your advertisements, illustrations, form letters, circulars, booklets. Facilities for securing mail or store sales. Information cheerfully given; no charge. Write for catalog. Scott & Scott Advertising Agency, 220 West 42nd Street, New York.

A TEN DOLLAR advertisement on my truck reaches thousands new prospects three times a year in twenty counties of Western Pennsylvania. H. S. Weaver, Butler, Pennsylvania.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

OFFICE AND FACTORY EQUIPMENT

ADDRESSORS, duplicators, multigraphs, multicolors, dictating machines, etc. Bought, rebuilt, sold. Office Machinery Company, 22-C Quincy, Chicago.

50 name cards, 25c.; 50 business cards, 40c.; 50 envelopes, 35c.; 50 note heads, 30c.; samples, quantity prices, free. Standard Commercial Service, 518 Park Building, Worcester, Massachusetts.

PRINTING, ENGRAVING, MULTIGRAPHING

5000 1 x 2 Labels $2.50. Save 30%. Wolf Labels, Station E, Philadelphia.

CARD-CASE Free with order for 50 linen calling cards 30c; 100, 50c. R. Constance, 3228 Montgall, Kansas City, Missouri.

250 Letter Heads, Bill Heads, Envelopes and Cards Complete for $5.00. 250 Letter Heads and Envelopes $2.75. Postpaid. Balkow Printing Company, Meriden, Connecticut.

LETTERHEADS $2.50 thousand. Samples free. Quality Print Shop, Marietta, Ohio.

BETTER printing for less money! Send for our large package of samples of hundreds of items every user of printing is interested in. These samples worth dollars will be sent for 10 cents to pay postage. Ernest Fantus Company, 525 South Dearborn Street, Chicago.

THESE prices for high grade printing. 5,000 8½ x 11 bond letterheads, prepaid $14.00. 5,000 extra high quality 6¾ 28-lb. env. $14.50. 10,000 circulars (Warren's Paper) up from $16.75. Very special prices on long runs. Modern plant standardized upon small advertising literature and catalogs. Satisfied customers in 24 states. Save money as others do, with the The Times Printery, St. Francisville, Illinois.

PRINTING—the Better Kind. Gummed Labels. Advertising Stickers. Prices on request. Olde Tye Press Company, 328 Richards Avenue, S. Dover, New Jersey.

ENGRAVED stationery at 60% saving. Plates unnecessary. Cards, Letterheads, Announcements, etc. Samples sent. Alden Non-Plate Engraving Company, 15 Avon Street, Boston, Massachusetts.

ADVERTISING stickers! Rubber stamps! Samples free. Edward Harrison, "Labels," Baltimore.

GUM Labels that stick anywhere. Catalogue free. Box 137, Newfield, New Jersey.

ENGRAVED Stationery at Printers prices. Finest Printing. Send for samples and prices. Mention quantities. Whitworth Bucher, 160 North Wells, Chicago.

OUR Multigraph letters produce results. Long runs. Special quotations. Samples. Marietta Multigraphing Co., Marietta, Ohio.

125 Letterheads and 125 Envelopes, $2.10 postpaid. Samples 6c. Wellman Printing, Huntington, West Virginia.

TWINS Print Business Cards get the business. Send for Samples. Twin Printing Co., 2741 Magnolia Ave., Chicago.

EMBOSSED Business, Personal Stationery. Samples, Stamp. Daniele P. Company, Pittston, Pennsylvania.

100 Letterheads, 100 Envelopes, $1.35. Others reasonable. Economic Printery, Leonia, New Jersey.

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TYPEWRITERS AND SUPPLIES

RE-MANUFACTURED typewriters at reduced prices. Shipped for 5 days' trial. Write for our Catalog No. 25 and save money. Beran Typewriter Company, 58 West Washington Street, Chicago.

SPORTING GOODS

BROWNE'S Semi Automatic—safest pistol made. Shoots all sizes .22 cal. cartridges, $10.50. Bayard Midget Automatic .25 cal. $15.50; .32 cal. $17.50 postpaid. Lowest prices in America on Colt, Smith & Wesson, Savage, others. Booklet mailed free. Standard, 843-5 Broad Street, Newark, New Jersey.

TOBACCO

OLD Kentucky smoking tobacco mild or strong, 3 lbs. $1.00 postpaid. Raymond L. Daniel, Owensboro, Kentucky.

FOR SALE

CHOICE Silverblack breeding foxes. Instructions. Reid Bros., Bothwell, Ontario.

FOURTEEN-INCH cut glass Flower Vase, $6.00 postpaid. Send for photo. Box 137, Newfield, New Jersey.

PICTURES AND POSTCARDS

JOIN Live Postcard Club. Membership Papers 10c. Harvey Teeple, Decatur, Indiana.

TRUE-BLUE friends everywhere. Exchange postals. Club organized 1908. Membership: Year, $1; half, 50c., quarter, 25c. Book, hundreds listings, 10c. Ed Ericson, PS621, Elroy, Wisconsin.

I'll Show You How to Get a Job You Can't Lose!

Every newspaper in the country is full of stories about men being thrown out of work. We are facing a period of depression which many say will lead to "soup kitchens and bread lines." Already in New York State 125,000 people are idle. "At the present rate," says the Daily News Record, "there will soon be two workers for each job." In Philadelphia in one line of business alone 40,000 employes were dropped. In New England mills and factories are closing every day. In the South, with cotton

selling at new low levels wages are being cut and factories are closing in every section. In Detroit it is reported that the automobile plants laid off 100,000. In Akron the tire companies are running only 25 per cent of their capacity. In every city in the country, from Coast to Coast, people are working part time, or looking for work or accepting radical reductions in wages.

How Soon Will You Be Out of Work?

Are you going to wait until YOU are out of work before insuring yourself against loss of income—or are you going to get a job NOW that you cannot lose? That kind of a job is—working for Uncle Sam in any of the numerous branches of the Civil Service. According to Federal Law you cannot be fired or laid off for any religious, personal or political reason. Hard times do not affect the government employe. There are no strikes or lockouts. Your pay comes regularly all year round. You can COUNT on exactly what you will get. Increases are rapid in position and salary.

Let Me Train You for a Job With Uncle Sam

Uncle Sam is careful about his employes. You must pass a Civil Service Examination before you are accepted. There are certain things you MUST know. It is my business to PREPARE you for the examination so you can pass successfully. For eight years I was a Civil Service Secretary-Examiner, so I am perhaps the best qualified man in the country to coach you. **I guarantee** to coach you until you succeed in GETTING A POSITION.

$1600 to $2300 a Year

No Strikes—No Layoffs—No Lockouts

Figure your earnings for the past year and if you are an average man you didn't get as much as the average government employe! That is due to strikes, lockouts, slack work, layoffs — none of which can happen to Civil Service employes. They get $1600 to $2300 a year to start and **they get it.** Other positions in the government service pay as high as $3000 to $10,000 a year! Hours are easy—eight or less a day. Vacation every year with full pay, work at home or travel, or work in Washington or at Panama Canal.

Get My Free Book

If you are an American citizen 18 years old or more you are eligible to a Government Civil Service Position, and if you have a common ordinary 4th grade education as a foundation I want you to have a copy of my splendid fully illustrated book, telling you how to secure it. Send in the coupon today or just a postal card.

Arthur R. Patterson,
Principal, Patterson Civil Service School
Dept. 166, News Building,
ROCHESTER, N.Y.

Patterson Civil Service School,
Arthur R. Patterson, Principal
166 News Bldg., Rochester, N. Y.

Please send me your free book about Government positions.

Name.......................

Address.......................

City................. State......

Quick-Action Advertisements continued on page 10

Quick-Action Advertisements continued from page 9

Quick-Action Advertisements continued on page 12

NAME	POSITION	SALARY
John	AUTOMOBILE ENGINEER	$125 A WEEK
	REPAIR MAN	$50 A WEEK
	CHAUFFEUR	$30 A WEEK

Put Your Name On This Pay-Roll

Men like you are wanted for big-pay positions in the fascinating field of automobile engineering. We have made it easy for you to fit yourself for one of these positions. You don't have to go to school. You don't have to serve an apprenticeship. Fifteen automobile engineers and specialists have compiled a spare time reading course that will equip you to be an automobile expert without taking any time from your present work.

AUTO BOOKS

6 Volumes Shipped Free

Now ready for you—an up-to-the-minute six-volume library on Automobile Engineering, covering the construction, care and repair of pleasure cars, motor trucks and motorcycles. Brimming over with advanced information on Lighting Systems, Garage Design and Equipment, Welding and other repair methods. Contains everything that a mechanic or an engineer or a motorcyclist or the owner or prospective owner of a motor car ought to know. Written in simple language that anybody can understand. Tastefully bound in American Morocco, flexible covers, gold stamped, 2,650 pages and 2,300 illustrations, tables and explanatory diagrams. A library that costs thousands of dollars to compile but that comes to you free for 7 days' examination.

Partial List of Contents

- More than 100 Blue Prints of Wiring Diagrams
- Explosion Motors
- Motor Construction and Repair
- Carburetors and Settings
- Valves, Cooling
- Lubrication
- Fly-Wheels
- Clutch
- Transmission
- Final Drive
- Steering Frames
- Tires
- Ignition
- Vulcanizing
- Starting and Lighting Systems
- Shop Kinks
- Commercial Garage Design and Equipment
- Electrics
- Storage Batteries
- Care and Repair of Motorcycles
- Commercial Trucks
- Glossary

Only 10c a Day

Not a cent to pay in advance. First you see the books in your own home or shop. Just mail coupon and pay express charges when books arrive. You can read them and study them for seven whole days before you decide whether you want to keep them or not. If you like the books send only $2.80 in seven days and $3.00 a month until the special introductory price of $24.80 has been paid. (Regular price $45.00.) Along with the set goes a year's consulting membership in the American Technical Society. (Regular price $12.) This great bargain offer must soon be withdrawn.

Send No Money Now

Don't take our word for it. **See the books without cost.** There is so much profit in this offer for you, that we urge you to waste not a moment in sending for the books. **Put the coupon in the mails today. Send no money—Just the coupon!**

American Technical Society, Dept. A-20a
Chicago, Ill.

Dept. A-20a

AMERICAN TECHNICAL SOCIETY
Chicago, Illinois

Please send me the 6-volume set, Automobile Engineering, for 7 days' examination, shipping charges collect. If I decide to buy, I will send $2.80 within 7 days and the balance at $3 a month until $24.80 has been paid. Then you send me a receipt showing that the $45.00 set of books and the $12 Consulting Membership are mine and fully paid for. If I think I can get along without the books after the seven days' trial I will return them at your expense.

Name.....

Address.....

Reference.....

PATENTS promptly procured. Send disclosure of invention, design or trademark for actual search of U. S. patents and novelty report. Validity and infringement investigations. Patent and trademark suits prosecuted and defended anywhere in the United States. Discriminating clients appreciate my efficient service. No literature will be sent you as this is a professional service. Individual and personal. Specific information and advice given regarding each individual case. Specialize in prosecution of pending cases that have been previously rejected by the Patent Office. Specialize also in unfair competition litigation before the Federal Trade Commission. George P. Kimmel, Master of Patent Law, 3811, Loan and Trust Building, Washington, D. C.

PATENTS, Trade Marks, Copyrights. Prompt, personal, reliable service. Over 30 years' active practice. Write for terms. Book free. Address E. U. Siggers, Box 1, N. U. Building, Washington, D. C.

MONROE MILLER, Ouray Building, Washington, D. C., patent attorney, mechanical and electrical expert. Best quality of work and results. Moderate charges.

INVENTORS—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster and Allwine, 232 Ouray Building, Washington, D. C.

PATENTS procured—trade marks registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Building, Washington, D. C., or 2276-Z Woolworth Building, New York.

"INVENTOR'S Guide" free on request; gives valuable information and advice. Frank Ledermann, 15 Park Row, New York.

PATENT, Trade-mark and Copyright specialist. Prompt, personal and efficient service. Advice on request. M. E. Jones, Lawyer, 509C 7th Street, Washington, D. C.

INVENTORS, send sketch or model of your inventions for opinion, concerning patentable nature and exact cost of applying for patent. Book, "How to Obtain a Patent," sent free. Gives information on patent procedure and tells what every inventor should know. Established twenty-five years. Chandlee & Chandlee, 405 Seventh Street, N. W., Washington, D. C.

PROTECT your rights. Write for "Record of Invention" which contains form to establish evidence of conception of your invention. Prompt personal service. Preliminary advice without charge. J. Reany Kelly, 832 Southern Building, Washington, D. C.

PATENT application filed on partial payment plan. Trade-marks, copyrights, etc. Milo B. Stevens & Co., 640 F Street, Washington, D. C.

PATENTS procured. Trade-marks registered. Moderate charges. Advice and booklet free. Lloyd W. Patch, Washington, D. C.

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AGENTS AND SALESMEN WANTED

SELL World's Greatest Auto Invention; no more storm blurred windshields; Mystic Chemical Felt works wonders; one rub keeps glass clear 24 hours; steel mountings; fits pocket; whirlwind seller at $1.00; Vetter made $75 first day. Security Mfg. Co., Dept. 306, Toledo, Ohio.

AGENTS—Make a dollar an hour. Sell Mendets, a patent patch for instantly mending leaks in all utensils. Sample package free. Collette Mfg. Company, Dept. 467, Amsterdam, New York.

AGENTS—make 140% profit. Each sale $2.00—costs 84c. Your profit $1.16. Something different. Eradium (Luminous) Crucifix actually shines in the dark. Startling! Novel! Everlasting! Wonderful enthusiasm follows every demonstration. Sold manufacturers. The Pioneer Corporation, 1263 West 63d Street, Chicago.

SALESMEN wanted to sell Electric Cigar Lighters and Moisteners. Salary or Commission. You carry stock or we ship direct. Write for Special Offer. Drake Manufacturing Company, 220 Grand, Milwaukee, Wisconsin.

BIG Money and Fast Sales. Every owner buys Gold Initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Company, Dept. 47, East Orange, New Jersey.

AGENTS make 500% profit handling auto monograms, new patriotic pictures, window letters, transfer flags and novelty signs. Catalog free. Hinton Company, Star City, Indiana.

MAN in each town to refinish chandeliers, brass beds, automobiles, by new method. $10 daily without capital or experience. Write Gunmetal Company, Avenue "F," Decatur, Illinois.

PATENTS. Write for Free Illustrated Guide Book. Send sketch or model for free opinion of its patentable nature. Highest references. Prompt attention. Reasonable terms. Victor J. Evans & Co., 174 Ninth, Washington, D. C.

SALESMEN, high grade, for state and county agencies; practical device rings electric bells forever without batteries; made by leading manufacturer. Sound, permanent business; men are already making good money; territory being rapidly assigned; references and previous experience essential. Betts & Betts Corporation, Betts Building, 42nd Street, New York.

AGENTS—Catchiest Novelties Invented! Aerial toys make youngsters wild with joy. Easiest seller. Big profit, exclusive territory offered. Write immediately for particulars. H. Marui Company, Tribune Bldg., New York.

AGENTS: Big profits. Best and cheapest window letters made. Easily applied. Dime brings five samples. Particulars free. Stalbrite Company, 1115 Second Avenue, New York.

SIGN Agents to represent us in your locality; unlimited field. Samples free. Interstate Sign Company, Dept. A, 2620 North Halstead Street, Chicago.

AGENTS: Duo Antiseptic Iodine sells like wildfire. Everybody wants Iodine now. Other big sellers. Immense profits. Territory going fast. Write quick. Duo Company, Dept. I 66, Attica, New York.

AGENTS—Cash in on Prohibition; $43 to $58 weekly; new fast-selling articles going like wildfire; agents cleaning up; write today for particulars. American Products Co., 4888 American Building, Cincinnati, Ohio.

COLD CREAM! Marketed 8 years; proved popular, dependable, profitable (400%). Quickly made—no machinery. Formula $3—absolute money-back guarantee. M. Hall, No. Easton, Massachusetts.

SALESMEN—Earn $3,500 to $10,000 a year. City or traveling. Experience unnecessary. Quickly qualify through our amazing system. Free employment service to members. Send for salesmanship book, list of lines and full particulars. National Salesmen's Training Association, Dept. 126G, Chicago, Illinois.

AGENTS: Sell rich looking 36x68 imported rugs, $1.00 each. Carter, Tenn., sold 115 in 4 days; profit, $57. You can do same. Write for sample offer and selling plan; exclusive territory. Sample rug by parcel post prepaid $1.39. E. Condon, Importer, 12 Pearl Street, Boston, Massachusetts.

KEROSENE Burners for Furnaces, Cook and Heating Stoves. Economy Mfg. Company, 616 West Monroe, Chicago.

AGENTS, $60 to $200 a week. Free samples. Gold Sign Letters for Store and Office Windows. Anyone can do it. Big Demand. Liberal offer to general agents. Metallic Letter Co., 431A N. Clark St., Chicago.

WHISKEY, Brandy, Rum, Champagne, Wines. 50 other Non Alcoholic flavors, for soda fountain, foods, etc., outselling all others on the market. One salesman sold over a thousand dollars worth in one week. Write to-day for particulars and proof. Sample of any flavor mailed postpaid for $1.00. Crouch, Chemist, 309 Broadway, New York.

$11.00 a day for 5 hours' work. New method—no capital required—no deliveries—no delays—just take orders and bank big profits. Davis Products Co., Dept. 57, Chicago.

AGENTS' outfit, 16 jokers' samples, 10c. Chambers Printing Works, Kalamazoo, Michigan.

FASTEST dollar seller on the Automobile market. 100% to Agents. Permanent repair for inner tubes. Every Motorist will buy. Vul Tex Mfg. Co., Minneapolis, Minnesota.

$10 WORTH of finest toilet soaps, perfumes, toilet waters, spices, etc., absolutely free to agents on our refund plan. Lacassian Co., Dept. 615, St. Louis, Missouri.

SENSATIONAL Opportunity. One sale a day means $200 per month! Five sales, $1,000 per month! Marvelous new adding machine. Retails $15. Work equals $350 machine. Adds, subtracts, multiplies, divides, automatically. Lightning speed. Errors impossible. Five-year guarantee. Used by U S Government and largest corporations. Tremendous demand everywhere. Amazing profits. Write quick for trial offer and protected territory. Calculator Corporation, Dept. O, Grand Rapids, Michigan.

EARN $2.00 an hour in your spare time taking subscriptions for this magazine. Write to-day for the agency in your town. Popular Science Monthly, 225 West 39th Street, New York.

EASY, pleasant work for mechanics, shop men, clerks, during spare hours, will add many dollars to their salaries. Also want persons who can give full time. Big wages assured. Novelty Cutlery Company, 27 Bar Street, Canton, Ohio.

AGENTS—Best seller; Jem Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 800 per cent; put it on cold, it vulcanizes itself in two minutes, and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., 504 Amazon Building, Philadelphia, Pennsylvania.

SIGNS for stores and offices. Entirely new. $50 week easily made. Chicago Sign System. T-326 River Street, Chicago.

MANUFACTURE same or better goods than you're buying elsewhere. 300 to 1,000% more profit for yourself. Stamp brings valuable information, reliable, latest money making propositions, formula lists; food, laundry, toilet, medical, household, automobile specialties. New big sellers for beginners, small manufacturers, all lines. 23 years acknowledged headquarters for best chemical service by leading manufacturers. Miller, Industrial Chemist, Tampa, Florida.

SELL necessities. Everybody needs and buys the "Business Guide." Bryant cleared $800 in July. Send for sample. It's free. Nichols Company, Box 1B, Naperville, Illinois.

BIG profits selling Duplex Transformers. Every auto owner needs them. Save gas. Banish spark plug trouble. Exclusive territory. Write quick. Jubilee Mfg. Company, 54, Station C, Omaha, Nebraska.

WORLD'S fastest selling auto accessory! County distributors wanted; write to-day. G. L. W. Spring Oiler Co., San Diego, California.

LUMINOUS PAINT—Makes any article visible in the dark. Bottle, 50c. Guaranteed. Sample, particulars for "Red" stamp. Illuminant Company, 744EP North Lockwood, Chicago.

FORDS start easy in cold weather. Will run 34 miles per gallon on cheapest gasoline or half kerosene, using our 1921 carburetors. Increased power; styles for all motors; can attach them yourself. Big profits to agents; money back guarantee; 30 days trial; Air Friction Carburetor Co., 1508 Madison Street, Dayton, Ohio.

56 Miles per gallon made with new patented gasoline Vaporizer. Write for particulars. Vaporiser Company, Pukwana, South Dakota.

MEN and WOMEN—Become independent—own your business, experience unnecessary selling our $6,000 Accidental Death, $30.00 Accident, $25.00 Sick Weekly Benefits, $10.50 yearly, half amounts $5.50. Guaranteed steady income from renewals. $250,000 deposited Insurance Department. Registration Dept. S, Newark, New Jersey.

BE successful—Easy sales—Big money. Only $1.00, Double Edge Razor. Standard Safety Razor Corporation, Pittsburgh, Pennsylvania.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

AGENTS—Something new, Music Chest. Marvelous invention. Does more than machines costing 20 times its price. We paid Ted Gnau $4,445 for four months work; Grats made $394 one week; Jest made $7,285 in six months; eight men placed over 16,000 Music Chests. Write for terms, sample and territory. Thomas Manufacturing Company, Class 2361, Dayton, Ohio.

DISTRICT Managers wanted for tremendously successful new office specialty. Two minute demonstration means sale. Wonderful repeater. Gold mine for you. Perfection Mfg., 123 So. Fourth, Philadelphia, Pennsylvania.

AGENTS—$20 a day taking orders for Insyde Tyres. Positively prevent punctures and blowouts. Guaranteed double tire mileage. Old worn out casings will give 3 to 5 thousand miles more service. No tools needed. Just slip inside casing before replacing tube. Will not heat or pinch. Kats made over $500 first month. Biggest thing on the market. Low priced. Write for territory. American Accessories Co., B-1079, Cincinnati, Ohio.

$15.00 DAILY selling the New Amberold Unbreakable Combs; kind you can hit with a hammer; write for wholesale prices. J. Bucknam, Box 2792, Boston, Massachusetts.

MAKE $25 to $50 week representing Clows' Famous Philadelphia Hosiery, direct from mill—for men, women, children. Every pair guaranteed. Prices that win. Free book "How to Start" tells the story. George Clows Company, Desk 24, Philadelphia, Pennsylvania.

AGENTS: Sell Gloss Oil Veneer—The Wonder Polish. Cleans and polishes furniture, cars, etc. Sells in every house. Get your field at once. Duo Company, Dept. G 66, Attica, New York.

AGENTS—Newest Invention! "Inkspoon" makes every pen a fountain pen. Fast office seller; big profit. Demand increasing everywhere. Exclusive territory offered. Sample free. H. Marui & Company, Tribune Building, New York.

GET our plan for monogramming automobiles, trucks, hand luggage and all similar articles by transfer method; experience unnecessary; exceptional profits. Motorists, Accessories Company, Mansfield, Ohio.

$5,000 is yours in 1921—Greatest auto accessory ever invented—Exclusive territory. Free samples to convince you. Wellman Muter Corporation, Chicago, Illinois.

AGENTS and portrait men. Crew Managers. We give you more for your money. Better and quicker service. Lowest prices on frames and glass. Rejects credited. Catalog free. The Pioneer Corporation, 1263A West 63rd Street, Chicago.

SALESMEN wanted in this district to sell our line of office appliances. Liberal commission. No investment. No samples to carry. Every office, factory, and store a prospect. Golding Mfg. Co., Franklin, Massachusetts.

BEGINNERS' complete mail order system. PS., Box 1005, Atlantic City, New Jersey.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contain some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

WONDERFUL New Chemical. $1.00 Package equal 50 gallons gasoline. Eliminates carbon. 50% more mileage, power, speed. Guaranteed. Whirlwind seller. Auto owners buy on sight. 100% profit. Repeater. Demonstrating package, terms, territory, 10c postage. Myers & Company, 36 Baird, Cambridge, Ohio.

PORTRAIT Agents—Who want good work and prompt service, who desire to purchase their frames at factory prices should write us at once for catalog and price list. W. G. Hannan Company, Dept. A-15, 57 East 18th Street, Chicago, Illinois.

SELL Perfume Blocks. One 50c Block perfumes an entire room for two months. Used in trunks, clothes closets, sick rooms, theatres, enclosed automobiles, etc. 100% profit. International Chemical Company, Box 174D, Cleveland, Ohio.

TIME Saving Wrenches and other tools used by all Garages. You can sell them in spare time. Write to Mr. Seiter, Fairbanks Company, New York City.

AGENTS—$100 Weekly. Automobile owners wild with enthusiasm. Marvelous invention doubles power, mileage, efficiency. Saves cost first day. Sensational sales everywhere. Territory going like wildfire. $26 sample outfit and Ford Car free. Write quick. Ovee Co., Dept. 181, Louisville, Kentucky.

"THE SCHEMER," Alliance, Ohio, 32 pages monthly, prints schemes, tips, formulas that pull big money; helped one subscriber make $25,000. You want that kind; subscribe to-day! Year, $1.00; trial, 3 months, 25c.

THREE Dollars starts prosperous business merchandising by mail; our complete outfit with copyrighted instruction shows How. J. L. Glaser, 1 Madison Ave., New York City.

FREE booklet of extraordinary testimonials from people all over the world who have been cured of Rheumatism by our wonderful Herbs. $1.50 per pound. Agents price 15 lbs. $5. Exclusive territory given. Rheumatism Herb Company, Box 96, Ocean Park, California.

WISE agents sell their own goods instead of paying manufacturer's swollen profits. Send for free book which lists our wonderful, tested and guaranteed formulas. Every product a seller. You can build a big business by employing others to sell for you as well as get all the profits from your own efforts. Write to-day. National Scientific Laboratories, 620 East Main, Richmond, Virginia.

SEND for free booklet of letters from our Agents who are building up a good business selling our goods by mail order or local trade. An order for five dollars ($5.00), of goods, will start you in exclusive territory. R. H. Company, Agent's Dept. 102, Ocean Park, California.

350% Profit selling Klean-rite Magic Clothes Washing Wonder. Sells 25c. Profit 19c. Sample free. Bestever Products Company, 3253-BJ, Belleplaine, Chicago.

AGENTS—Handle Ry-Hy fast selling products, valve grinding compound, windshield clearer, spring oil, etc. Write for particulars. Ry-Hy Manufacturing Company, Stamford, Connecticut.

OUR EX-CEL Luminous Crucifix sells on first demonstration—Shine brilliantly in the dark. Big profits. Write now for prices. W. G. Hannan Company, Dept. D., 57 East 18th Street, Chicago.

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AUTOMATIC Kuff Buttons, opens and closes cuffs automatically, when sleeves are raised or lowered. Great convenience and shirt savers. Sells like wildfire. Sample pair $1.00. Liberal proposition for state agents only. Flexo Mfg. Cops., Sheboygan, Wisconsin.

SELL ladies' all rubber athletic and bathing garters. Complete selling outfit (including 24 pairs) $2.00. Renniebut Rubber Co., 8 Van Wagenen, Newark, New Jersey.

AGENTS: Everybody uses Extracts. Sell DUO Double Strength Extracts and complete line Household Necessities. Products used constantly. Big repeaters. Write today. Duo Company, Dept. E 66, Attica, New York.

AGENTS—Something new. Write quick for particulars. F. O. Spaulding, Fairfield, Maine.

EVERY Automobile Owner wants gold initials on door of his car. Transfer them yourself without experiences Profit $1.40 on $1.50 job. Write or call. Novelty Monogram Company, 192 Market St., Room 706, Dept. A, Newark, New Jersey.

BIG money selling and fitting new Phonograph Reproducer. Silk diaphragm. No scratching. Wonderful tone. A trial will convince the most critical. Best for needle records on Edison. Sample, nickel plated, $6.50. Cash with order. Get your sample and territory and get busy. Mechanics Supply Co., Gateway Station, Kansas City, Missouri.

Quick-Action Advertisements continued on page 14

Reach Up Young Man

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Dept. 8J, 375 Lexington Ave., New York City

I am interested in the position or home-study course I have marked. Please give full information.

Salesman	Bookkeeper
Stenographer	Civil Engineer
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Better Letters	Electrical Engineer
Business English	Electrician
Factory Management	Steam Engineer
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Mechanical Engineer	Plumber
Draftsman	Farm Motor Mechanic
Illustrator	Architect
Advertising Man	Building Contractor
Accountant	Agricultural Courses
Auto Mechanic	Poultry Husbandry
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Name and Occupation

Address

UNITED YMCA SCHOOLS

Don't be content with your present ability and your present place in the world's affairs. You have it in you to become a bigger man, to shoulder larger responsibility, to do more, to earn more, to serve more, to enjoy more.

The men who have gone past you were not just lucky fellows. They had better training. You, too, can get better training. You can be valued for what you know rather than what you can do with mere muscle.

No matter what you have missed in the way of general or special education you can make up for it. Many years ago the Y. M. C. A. Schools were organized for the young men who had ambition to use spare hours in putting more into their heads. These schools have grown until in 1920 more than 120,000 young men studied under the guidance of earnest Y. M. C. A. instructors. With correspondence instruction added to day and evening classes, we are in a position to help many more thousands.

The United Y. M. C. A. Schools offer you standardized courses of great variety—more than 200. Our instruction is of the most concise and practical kind, prepared to meet the needs of men at work, and *sold at very reasonable prices*.

The case of every student is carefully considered and he is advised to enroll only for that course which will most likely develop his talents and open an opportunity for bigger things.

You owe it to yourself to learn what the United Y. M. C. A. Schools are doing for many thousands of ambitious people. Don't think that your case is different. We have probably had hundreds of similar cases.

If it is not convenient for you to call at some Y. M. C. A. for further information, just tear out, fill in and mail the Inquiry Coupon above and learn about the Y. M. C. A. standards in correspondence instruction.

This month—NOW—is the time to begin your training. Your big opportunity may come sooner than you expect. Be prepared for it.

NEW invention. Oil Gauge for Fords. Sells on sight. Big profits. Small investment. Exclusive territory. Unusual opportunity for agents and salesmen. Address Sales Mgr., 14 Sta. C., Omaha, Nebraska.

AGENTS: We pay $9 a day taking orders for 300 candle power coal-oil Lantern Get orders from farmers, dairymen, bucksters, gardeners, contractors. Auto furnished to travel in. Write for particulars. Thomas Mfg. Co., Class 2961 Dayton, Ohio.

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HELP WANTED

DETECTIVES Earn Big Money. Excellent opportunity. Travel. Fascinating work. Experience unnecessary. Particulars free. Write American Detective System, 1968 Broadway, New York.

BE a detective. Excellent opportunity, good pay, travel. Write C. T. Ludwig, 424 Westover Bldg., Kansas City, Missouri.

STOP daily grind. Start silvering mirrors, Auto headlights, tableware, etc. Plans free. Clarence Sprinkle, Dept. 95, Marion, Indiana.

BE a Mirror Expert, $3-$10 a day; spare time home at first; no capital; we train, start you making and silvering mirrors, French method. Free prospectus. W. F. Derr, Pres., 579 Decatur Street, Brooklyn, New York.

FIREMEN, Brakemen, Baggagemen, $140-$200; Colored Porters, by railroads everywhere. Experience unnecessary. 838 Railway Bureau, East St. Louis, Illinois.

OUR genuine gold window sign letters are an excellent money-making proposition for handy men. Slann Sign System, 7505 St. Antoine, Detroit, Michigan.

MEN—Age 17 to 45. Experience unnecessary. Travel, make secret investigations, reports. Salaries, expenses. American Foreign Detective Agency, 321, St. Louis.

MEN wanted at $35 to $100 a week to make mechanical drawings. Work is easy, pleasant, and leads to higher positions in Industrial Field at excellent salaries. We furnish set of instruments, train you at home, in spare time, by practical method and help you qualify for position. Write to-day for particulars. Roy C. Claflin, President, Dept. 1458, 14th and T Streets, Washington, D. C.

SILVERING mirrors, French plate taught. Easy to learn, immense profits. Plans free. Wear Mirror Works, Excelsior Springs, Missouri.

BE an Expert Penman. Wonderful new device guides your hand, corrects your writing in few days. Complete outline Free. Write Mr Ozment, 52, St. Louis, Missouri.

FOREIGN trade is the subject of great importance before Congress, our financiers and manufacturers. Our foreign business will require thousands of trained men and women. Properly trained students will have a splendid future. Write for our prospectus showing the only practical course offered. Foreign Trade Institute of Seattle, 706-A Arctic Building, Seattle.

MEN wanted for Detective Work. Experience unnecessary. Write J. Ganor, Former Government Detective 115, St. Louis.

WRITE Photoplays; $50 each. Experience unnecessary; details free to beginners. Producers' League, 194, St. Louis.

$150 Month Average. Railway mail clerks. Hundreds wanted. List positions free. Write immediately. Franklin Institute, Dept. K42, Rochester, New York.

DISTRICT Sales Manager—Having sold 150,000 of a household appliance in New England we wish District Managers to open other territory. Office work, entire or side line. Territory assignments are paying upwards of $5000 yearly. The Reeves Company, 52 Broad Street, Milford, Connecticut.

GOVERNMENT Clerks needed badly (men-women), $1600-$2300. Permanent. Few to travel. Write, Mr. Ozment, Former Government Examiner, 195 St. Louis, Missouri.

GOOD money easily earned at home, spare time silvering mirrors; no capital; free instructive book tells how. Paterson Company, Brooksville, Kentucky.

BIG money made silvering mirrors, metal plating, refinishing. Outfits free. F. Decie Laboratories, 286 Fifth Avenue, New York.

CLERKS (men, women), over 17, for Postal Mail Service, $125 month. Experience unnecessary. For free particulars of examinations, write J. Leonard (former Civil Service Examiner), 89 Equitable Building, Washington, D. C.

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BUSINESS OPPORTUNITIES

PATENTS—Book free. Send sketch for free opinion of patentable nature. Talbert & Talbert, 4847 Talbert Building, Washington, D. C.

SUBSTANTIAL manufacturing corporation wants capable men to establish branch and manage salesmen. $300 to $2000 necessary. Will allow expenses to Baltimore as explained. Address Mr. Clemmer, 603 N. Eutaw St., Baltimore, Maryland.

PATENTS Procured—Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Building, Washington, D. C., or 2276-Z Woolworth Building, New York.

EXPERT Chemist will furnish Formula and Trade Secrets in all lines. Lists free. W. L. Cummings, Ph. D., Gordon Avenue, Syracuse, New York.

BE a detective. Excellent opportunity, good pay, travel. Write C. T. Ludwig, 424 Westover Bldg., Kansas City, Missouri.

DOLLARS Yearly in your backyard. No mushroom dope. Particulars free. Metz, 252 West 41st, New York.

USED Correspondence Courses of all kinds sold. (Courses bought.) Lee Mountain, Pisgah, Alabama.

INVENTORS—My clients know every step taken in prosecuting their applications. Booklet sent free on request. Cuhberly & Kessenich, 20 National Union Building, Washington, D. C.

I MADE $25,000 with small Mail Order Business. Sample article 25c. Free booklet. Stamp. Alps Scott, Cohoes, New York.

ENTER a new business. Earn $3,000 to $6,000 yearly in professional fees making and fitting a foot specialty; openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks, at small expense; no further capital required; no goods to buy, job hunting, soliciting or agency. Address Stephenson Laboratory, 15 Back Bay, Boston, Massachusetts.

WE start you in business, furnishing everything. Men and women, $30.00 to $100.00 weekly operating our "New System Specialty Candy Factories" anywhere. Opportunity lifetime. Booklet free. H. Ragsdale Company, East Orange, New Jersey.

BUY and exploit practical inventions. Trade for property. Form companies. Sell county rights. Adam Fisher Mfg. Co., 183D, St. Louis, Missouri.

MANUFACTURING Co-operation: A large, modern Middle Western Manufacturing Institution will consider proposals from inventors and small manufacturers for the purpose of buying outright or manufacturing on royalty. Prefer light brass products, but will consider any high grade proposition. Write at once Box 338, Kokomo, Indiana.

MAKE Big Money making marble, onyx, agate, tile, etc., more beautiful and less than one-tenth cost of genuine. Marble and other fancy face brick, $15 thousand sell for $75. Cost of building reduced 25% to 50%. Experience unnecessary. Very little capital to start. Money-back guarantee if you fail with my instructions, based on 40 years' experience. Send for list of products and sample. B. F. Spencer, P. O. Box 213, Los Angeles, California.

2000% Profit Manufacturing Big Seller—New Field—$31.50 Buys Complete Equipment. Box 121-A, Akron, Ohio.

BUSINESS Brokerage easily understood. Big earnings possible. Details free. Eydman System, Box 647, St. Louis, Missouri.

AMERICA'S greatest fortunes have been made in manufacturing proprietary specialties. Investigate this business. Our free book will open your eyes to a wonderful opportunity. We supply guaranteed working formulas on which you can build a lasting reputation. Different, better, more profitable than others. Write to-day, National Scientific Laboratories, 620 East Main, Richmond, Virginia.

MAKE money at home making toys. We show you how. Send 50c Post Office order, "No Stamps," for complete working drawings and instructions. De Kalb Designing Company, 320 McDonough Street, Decatur Georgia.

PENMANSHIP

WONDERFUL PENMANSHIP! S. C. Malone, America's foremost expert in fine art engrossing, hereby offers to the readers of "Popular Science Monthly," the following reproductions direct from his matchless pen work:—Namely, Malone's superb alphabets, comprising eighteen complete styles of lettering, exquisite in conception, and perfect in execution, his famous Dewey testimonial, his soldier memorial, and numerous examples of hook plates, Library mottos, initial letters, title pages, diplomas, business cards, etc., for the small fee of five dollars, to all who order before June 15th, 1921. The originals of this work cost more than ten thousand dollars, and no such opportunity has ever before been offered to the art student. Mr. Malone gives mail courses in all practical and remunerative branches of art. Address S. C. Malone, Artist Penman, Heraldic, Genealogical and Handwriting Expert, 331 North Charles Street, Baltimore, Maryland.

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STAMPS AND COINS

51 different stamps, also packet 5 unused, China ship set, 2 scarce animal stamps, large $1.00 U. S. revenue, perforation gauge, millimeter scale, ruler and price lists. All for 9c. We Buy Stamps. Fennell Stamp Co., Dept. C., Fullerton Bldg., St. Louis, Missouri.

CALIFORNIA gold, quarter size, 27c; $½ size, 53c. White cent and catalogue, 10c. Norman Shultz, Box 146, Colorado Springs, Colorado.

500 different stamps $1.30, 200, 27c; 100, 12c. Approvals. Michaels, 5600 Prairie, Chicago.

CALIFORNIA Gold, quarter size and German 5pf 30c. Villa coin and catalog 10c. Homer Shultz, Union Star, Missouri.

158 Genuine Foreign Stamps—Mexico War Issues, Venezuela, Salvador and India Service, Guatemala, China, etc., only 10c. Finest Approval Sheets 50% to 60%. Agents wanted. Big 72-p. Lists Free. We buy stamps. Established 25 years. Hussman Stamp Company, Dept. 55, St. Louis, Missouri.

STAMPS, 20 unused. All Different, 3 cents. Mention paper. Quaker Stamp Co., Toledo, Ohio.

$2 to $600 paid for hundreds of old coins dated before 1895. Send 10 cents at once for new illustrated coin value book. Size 4x7. It may mean your fortune. Clarke & Co., Coin Dealers, Box 76, LeRoy, New York

STAMPS—50 varieties, Transvaal, Brazil, Peru, Cuba, Mexico, etc., and Album 10c. 50 different U. S., 25c. 1,000 hinges, 10c, 1,000 mixed, 40c. List free. I buy Stamps. C. Stegman, 5949 Cote Brilliante, St. Louis, Missouri.

STAMPS—50 different British Guiana, China, Jamaica, Portugal, Venezuela, etc., 10c; 1,000 all different, fine collection in itself, $5 00; 100 var. U. S., 30c; 1,000 hinges, 10c. Agents wanted. 50%. List free. I buy stamps. L. B. Dover, Longmont, Colorado.

FRENCH Colonials, 25 different, only 10c. Nickles 122 Florida Avenue, Washington, D. C.

55 ALL DIFFERENT stamps, including China, Japan, French Colonies, etc , given to applicants for our high grade approval selections. Send references and 2c stamp to the Edgewood Stamp Company, Dept. M, Milford, Connecticut.

EUROPEAN War Stamp Packet Sent Free. Cornish, Schenectady, New York.

AUSTRIAN war scenes, beautiful set 5 different 12c. Jacob Fischer, 1539 North Lawler, Chicago.

25 different War Stamps, 25c. Buckey 712-A Bowen, Dayton, Ohio.

50 Different British Colonies, 15c. Browne, 111 Willow, Wollaston, Massachusetts.

THRIFT Stamps wanted. 21c each. Delbridge Investment Company, 5178 Enright St. Louis.

OLD coins, large Spring selling catalogue of coins for sale, free. Catalogue quoting prices paid for coins, ten cents. William Hesslein, 101A Tremont Street, Boston, Massachusetts.

The increasing use of electric motors in industry and home is a broad field for the inventor's genius and the machine manufacturer's workshop

Even a screw driver may be motor driven

EACH year brings to light some "new-fangled" machine which does the work of several hands or perhaps of a larger, more cumbersome machine—and the basis of such development is the fractional horse-power motor.

The growing preference for G-E motors for use in a wide variety of small machines is based upon three points which every manufacturer and dealer recognizes: the world wide reputation of the General Electric Company for building high grade electric motors of all sizes—the ability of G-E engineers to build into a device the motor which will do the work most satisfactorily—and the fact that the public will accept without question the G-E trade mark as a sign of guaranteed motor performance.

Designers and builders of small tools and machines will find G-E engineers ready and willing to co-operate in the application of motors to new uses, even though it may involve building a special motor or redesigning the machine to accommodate the proper motor.

Look for this mark of leadership in electrical development and manufacture.

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

55B-62

Popular Science Monthly

Waldemar Kaempffert, *Editor*

June, 1921; Volume 98, No. 6
25 Cents a Copy; $3 a Year

Published in New York City at
225 West Thirty-ninth Street

Stunting with a Three-Wheeled Tractor

And all three wheels are power wheels

By Raymond F. Yates

THIS is a tractor unlike any of those with which we are familiar. It is a three-legged machine. It is shown, with its designer, doing tricks. It is going over rifle-range butts, a dangerous thing for a tractor to do.

This machine is a fast worker. It is able to plow seven and one half acres in six hours' time. It would take a number of horses to do the same amount of work in the same amount of time. In plowing this acreage, the tractor uses only one and three quarter gallons of gasoline, which costs less than the feed a horse would eat in doing the same work.

The efficiency of a tractor is measured largely by the "pull" it has. The "pull" is measured in pounds. If a tractor has a "tractive effort" that is more than the weight of the machine itself, then the efficiency of the machine is high. This little tractor is able to make a continuous drawbar pull equivalent to 3250 pounds. It can pull up to 5600 pounds, which is more than the gross weight of the machine. Of course, this high pulling power cannot be maintained for any great length of time. It is only during momentary jerks that the machine is able to exert its maximum strength.

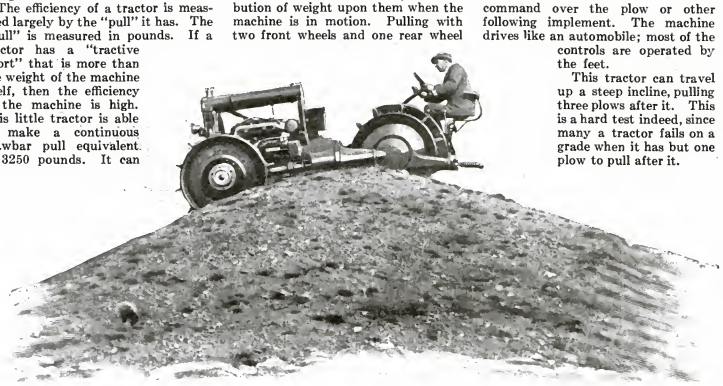
This tractor succeeds where other tractors fail because all of its wheels are provided with power. It is a three-wheeled machine and it is a three-wheel drive. The engine is connected with each of the wheels.

The tractor has been provided with three wheels for a good engineering reason. It excels in wheel grip because the three wheels have an equal distribution of weight upon them when the machine is in motion. Pulling with two front wheels and one rear wheel causes the wheels to press into the ground equally and evenly as the strain increases, thus insuring them against the common fault of slipping, skidding, and the danger of overturning. The low center of gravity also helps to keep the machine on its feet.

The little tractor is not only good for field work on the soil, but it may also be used as a general power unit on the farm. A pulley directly connected with the engine is provided for this purpose.

The driver's seat is placed at the side of the one rear wheel of the tractor, and the driver has a clear view of the work in front of him and command over the plow or other following implement. The machine drives like an automobile; most of the controls are operated by the feet.

This tractor can travel up a steep incline, pulling three plows after it. This is a hard test indeed, since many a tractor fails on a grade when it has but one plow to pull after it.



Doing stunts with a tractor on the rifle-butts. This three-wheeled farm tractor is seen here going over the top, with the man who designed it sitting at the wheel

How Science Tracks the Criminal

Europe is far in advance of the United States in crime detection

THE Sherlock Holmes type of detective, the man who smells a letter and tells at once that the murder was committed by a bald-headed man wearing eye-glasses, may seem a far-fetched creation of the novelist. His exploits have been overdrawn for the purposes of fiction, but his methods are sound. Above all things, he is a scientist.

In the whole United States there is no Sherlock Holmes—no detective who studies crimes objectively and dispassionately, just as an entomologist studies a bug for identification. The Europeans are far in advance of us in this respect.

There are no fewer than four chairs in as many European universities occupied by men who are professors of crime detection, the new science called "criminalistics." These men have laboratories in which the minds and methods of criminals are studied. In Graz, Austria, for example, you will see collections of all the known poisons of Europe, the sword-canes and rifle-canes with which assassins lie in wait to kill, plaster models and accurately drawn plans of crimes, the skulls of men who have been killed by blows on the head. Students who take the course in criminalistics are expected to look at a skull and say: "This man was killed by a hammer blow."

One graduate caught a murderer who had left behind him nothing but a derby hat in which there was a single hair. "Look for a man between forty-five and fifty, partially bald, with gray-streaked hair." The police found him.

Why did the scientific detective say that? Because by chemical and microscopic means it had been determined that there was perspiration in the hat; one of the hairs was gray, and it was the kind of hair that drops out of a head that is growing bald.

All modern science has been drawn upon in this tracking of the criminal.

Professor Gross, who founded the chair of criminalistics in the University of Graz, could look at the footprints of a man and determine whether he had been walking or running, whether he had been carrying a package or not, and even whether he was suffering from a disease. Bertillon, who did far more than give us the measurement system of classifying convicted criminals, went so far as to gather information on the methods used by Parisian shoemakers in nailing heels in place; for each shoemaker used a definite number of nails and hammered them in according to a plan of his own. Bertillon had only to look at a footprint in order to deduce the probable maker of the shoe that left the imprint.

An oxyacetylene flame was first used in Antwerp more than twelve years ago. Two burglars rented a room over a banking-office. They drilled a hole through the floor of their room and lowered themselves and the oxyacetylene apparatus by a rope ladder to the room below. The combination of the safe was simply burned away

Here is the apparatus that the burglars left in the hotel room that they had hired

The first step taken by a European criminalist is to make a scientific study of the scene of the crime. He uses either the scientific method of photographing devised by Bertillon—a method that makes it possible to measure with the utmost refinement on the photograph the distance of one object from another—or else he makes an accurate drawing, noting the exact position in which every object is found. Sometimes he even makes a three-dimensional plaster cast. He looks always for what is technically

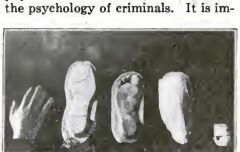
called "the error in the situation"—in other words, the little unforgotten thing or act that betrays.

Gross once found the dead body of an old man swinging from a chandelier. Suicide was the verdict of the police, and suicide was the first conclusion Gross drew. Then he studied his drawing. There was no chair near the man! Somebody must have hung him to the chandelier. The doctors assured Gross that the man had died a natural death! Then the real search began. Gross found that the old man had been left in charge of two servants.

One night, after he had fallen asleep, they decided to go to a dance. When they returned they found their charge dead. Frightened, the valet suggested that it would be well for them to make it appear as if the old man had committed suicide. Together they hung him, but they forgot to kick over a chair.

These men deal not only with the physical facts of crime, but also with the psychology of criminals. It is important to learn everything that can be learned of the loves and hates of thieves and pickpockets, their superstitions, and their slang. The criminal mind is not a normal type. It is firmly believed by thieves, in Europe at least, that something must be left on the scene of the crime to avoid detection. One man left behind two or three matches torn from a block of the kind given away in cigar stores. Professor Reiss, of the University of Lausanne, picked them up. He ordered all the suspects searched. A block of matches was found in the pocket of one. The two incriminating matches dovetailed into the stubs.

We need laboratories in America like those described above.



1 2 3 4 5

Plaster casts made in European detective laboratories in order to study crime scientifically

1. The hand of a criminal. 2 and 3. Plaster casts of footprints made with a booted and a naked foot. 4. Imprint of a criminal's knee. The scientific detective determined that the imprint was left by striped trousers made in Manchester.

5. A certain burglar bit a section out of a piece of cheese and threw the rest away. This is a cast of the bitten section. It showed that one tooth was missing and it enabled the police to find the burglar

Launching a Canoe with a Rope Railway

HIGH on a cliff a man built his house. As he sat on the veranda one day, watching the rippling water in the bay below, he was seized with a desire to go canoeing. But how could he and his canoe leap the cliff?

He planted a stake in the ground near his house, and drove another stake firmly into the bottom of the bay. He connected the two with a cable. On the cable he adjusted a metal bar by means of pulleys at both ends. Whenever he wishes to paddle on the bay, he chains the canoe to hooks located directly beneath the pulleys.

The canoe is lowered and raised by a winch operated by a gasoline engine. The cable from the winch is attached to the near end of the metal crossbar. And close to it is a brake-lever.

When the canoe reaches the water, it is unchained and allowed to go its own way. Some one must remain on shore to start and stop the winch.

The canoe is lowered from the cliff to the bay by means of a winch operated by a gasoline engine

To Make It Wave Long

A method of stitching the hem that has lengthened the life of flags

THE average life of a flag is thirty days of constant use. In the navy yard at Norfolk, a man who had never seen a flag made, J. H. Herbener, was given the job of increasing the flag factory's equipment and turning out flags for the Fifth District of the United States Navy. He soon noticed that all the flags returned for repairs were broken just behind the hem. This led him to make and test a flag without a hem.

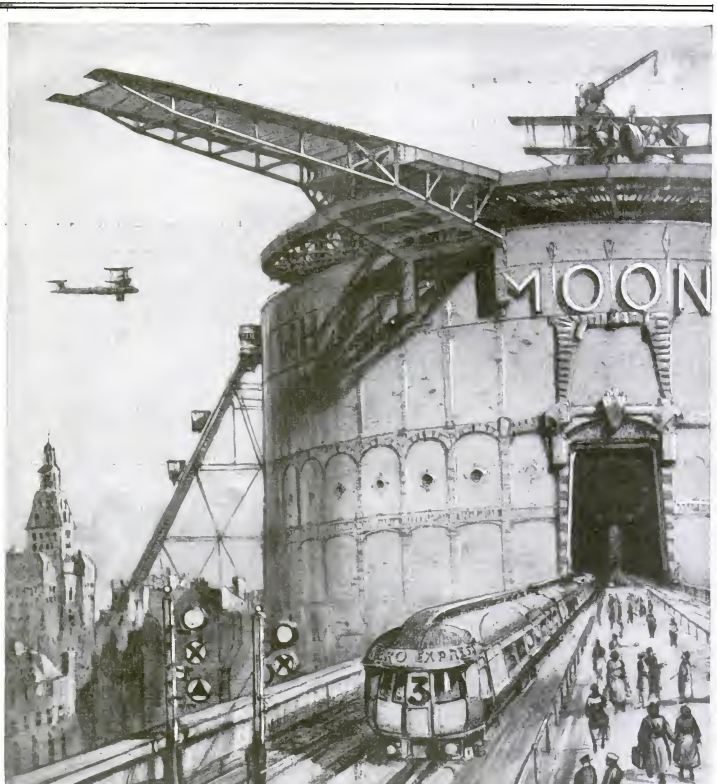
The hem was cut off a standard ensign, and rows of stitching run across the end several inches deep. Flown for four months on the navy yard flagpole, one hundred and twenty-five feet high, during the stormy spring months of the year, it was found that the flag broke down only on the end, and there but slightly. It had lost two rows of stitching at the corners and one in the middle.

A patent was taken out on the "wind-proof flag," and further experiments made. Lines of stitching in one color across the flag altered its appearance, so a method of stitching was devised to match the colors in the stitching and pattern. This was done by stitching across the cloth before the flag was made, the ends of the stitching at the edge of the stripe being wrapped up in the seams, thus sealing them against the wind.

Further experiments showed that strong winds sometimes blew out the outer line of stitching, and that the corners wore more rapidly than the center. To overcome this, V-shaped stitching was inserted in each stripe, with a half fan in the corners—a device that made the flag still stronger, but required a great deal of experiment to overcome puckering. Also a special kind of sewing-thread was invented for this purpose.

The wind-proof flag will not last forever, of course. But official tests at Washington have shown that it will last ten or twelve times as long as the ordinary hemmed flag—a big cut in expense for the government.

Starting on a Journey by



TRAVELERS in the picture above are hurrying, on foot and in railroad trains, toward a terminal the like of which is strange to our eyes, but which may be an accomplished fact in only a few years.

A glance at these persons hastening toward the terminal shows them taking the same kind of baggage that present-day travelers carry—and, indeed, travelers through the air will probably start with as slight preparation as they now do for a railroad journey and with far less preparation than for an ocean voyage.

In the huge circular station, built over a seaport, one airplane is shown about to land, a second is just starting on its flight, and a third is waiting for its new quota of passengers.

The airplanes start from and alight upon platforms swinging on a circular railed bed high in the air. The

Air in the Year 1930

Drawing by Roderic Hill

platforms are swung by two rotating arms, inclining a little downward, and moving with the wind, so that the machines always descend and ascend facing it—essential in starting and alighting.

A monorailway penetrates to the heart of the terminal, and an elevator carries passengers to and from the airplanes.

There is also a huge elevator for lowering the airplanes to the ground-floor whenever they are in need of repairs. Such repairs are carried on in the interior of the structure, in workshops where scores of skilled mechanics work to make the machines safe for transporting the human freight—employing the most modern labor-saving machinery, working at top speed, so that no unnecessary time may be wasted in an industry where every minute of idleness means financial loss

News by Parachute

HAVE you mailed your subscription to the *Aerial Mail?* If you want to keep in touch with what is going on in the air, you'd better get it in at once.

Yes, the latest publication is a daily, edited and printed on board an airplane in flight. The news is received by wireless, written, put into type, and printed on airplanes flying between London and Paris, so the edition must be printed in both English and French. Stock exchange reports receive special attention.

How is the *Aerial Mail* distributed? By means of parachutes, which drop appropriate editions over different towns.

The owner of this convex nose considered that it spoiled his looks

The hump has been cut away from inside the nose

You Can Now Have Your Nose Corrected

DOES the shape of your nose satisfy you? Is it convex, concave, crooked, or flat and unshapely? If you are not pleased with it, and if the fact makes you unhappy and morose, you can have the defect corrected without a scar.

Dr. Julien Bourguet, of Paris, France, has developed the art of æsthetic surgery and is able to give any one a nose approaching perfection. The operations are performed without cutting the skin, and usually within two weeks afterward the patient can step outdoors with an improved appearance. The æsthetic surgeon studies his patient's nose with the eye of a sculptor. Experience at once shows what is wrong. With skill more delicate than a sculptor's, the defect is eliminated.

First, local anesthesia produces insensibility to pain. The skin is then separated from the underlying framework, the operation being conducted through the nostrils. A miniature electric burr-saw, or surgeon's handsaw, cuts away the superfluous part of a convex nose. The skin is then allowed to readjust itself upon its improved support, and after about fourteen days the swelling disappears and the patient who formerly had, say, a convex nose now has a straight one.

In correcting concave noses the cause of the depression is considered, and in some cases an injection of hard paraffin is made. This builds up the "depression" and restores the line of the nose to normal straightness. Deflected noses are operated upon according to the kind of deviation. If the whole nose is crooked, the bones themselves are altered; but if there is only a slight deflection, the operation is more simple. But in any case the work is done from beneath the skin; no scar remains.

A telescopic, two-sectional cane and a bundle are here converted into a tent

She Carries Her Tent in Her Hand

WHEN a girl walks down the street with a cane in one hand and a small bundle in the other, she may be on a shopping-tour or she may be looking for a place to pitch her tent for the night. For that cane may be a collapsible tent-pole and the bundle a tent.

In the pictures to the left you see such a girl and such a tent. The material used in making the tent is very thin; thus when it is rolled up it makes a small bundle. It is, however, sufficiently strong to withstand hard wear. The cane consists of two telescoping sections that can be adjusted to any desired height.

Hitch a Bungalow to Your Car

"STOP at the Glenmore!" At regular intervals you see this sign as you tour through the country; you decide to stop there. But when you arrive, weary and worn, you find that the Glenmore is in the heart of the city on a noisy main street, or else that it is full.

Glenn Curtiss and his brother-in-law, G. Carl Adams, have solved this tourist's problem by inventing a bungalow on wheels that is attached to the automobile, trailer fashion. It is well equipped, and yet is not heavy enough to cause an excessive strain. When you wish to sleep, eat, or rest, you stop the car in some convenient place and move into the bungalow. There you will find a kitchen, a pantry, a bathroom, clothes and bedding lockers, a table, chairs, and berths that will accommodate six people. The bungalow even has electric lights and running water. The windows are all properly screened and they are also provided with water-proof curtains.

The bungalow is coupled to the automobile by a bar.

The bungalow is mounted on two wheels located near the center. The front end is coupled to the automobile

Take a bungalow with you when you tour. This one accommodates six people and contains all the comforts of home

Straight Up from the Ground

Oehmichen invents a new flyer

By Henry Mathis

Engineer of Arts and Manufactures, Paris correspondent of the Popular Science Monthly

THE fact that Oehmichen has used a balloon in rising from the ground makes us question the validity of his results as Mr. Mathis presents them. No one will be convinced that a practical helicopter has been invented until it has flown without buoyant gas. In its present form Oehmichen's helicopter is nothing but an airship driven vertically by horizontal propellers.

A successful helicopter must not only ascend straight up, but be able to descend slowly; it must be able to fly horizontally like an airplane; it must be stable. In our opinion, Oehmichen has not yet succeeded in solving the highly important problem of stability.—Editor.

EVERY one has seen a little toy consisting of nothing more than a screw propeller mounted horizontally on a vertical stick. You wind up a rubber band and then release it. The toy, driven by the horizontal propeller, rises straight into the air.

This toy is a true helicopter, by which term aeronautical engineers designate a machine that depends for support and propulsion upon screws alone. Pénaud, a Frenchman, invented this toy many years ago. Until Langley launched his small steam-driven airplane models in 1896, this toy was the only machine that ever flew.

There are obvious reasons why a helicopter should have enormous advantages over an airplane. As every one knows, an airplane must run along the ground for perhaps a hundred yards before it can fly, and also after it alights. A very large flying-field is, therefore, required. Hence we find that passenger-carrying commercial airplanes cannot start from the heart of a city, but must fly from some outlying field reached by car or railway. This is a serious limitation in the commercial use of the airplane. A helicopter, on the other hand, rises straight from the ground, a roof or deck.

Hardly a year passes but some inventor comes forth with a new helicopter. Not one has been successful, except Oehmichen, a classmate of mine at the École Centrale. Mr. Oehmichen is the first man who has ever risen from the ground with a helicopter.

The screws of Oehmichen's helicopter are really two wings of high efficiency, rotating in opposite directions

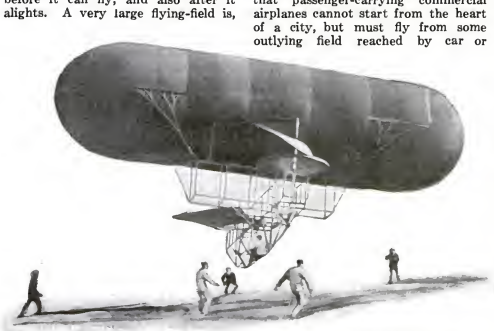
The screws on which Oehmichen depends are two wings of high efficiency, rotating in opposite directions. Their sustaining power is about 20 per cent greater than that of ordinary screws.

Oehmichen's first helicopter models were either too heavy or mechanically imperfect. Then he invented the recuperating screws with which his present machine is equipped.

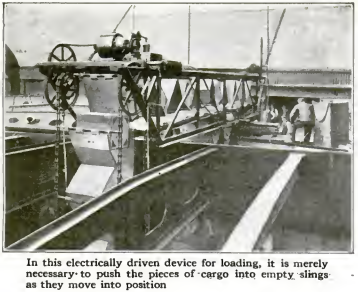
Oehmichen's helicopter weighs 572 pounds. The weight of the pilot is 167.2 pounds. The total weight is, therefore, 739.2 pounds. The apparatus is surmounted by a stabilizing balloon with a gas capacity of 5083.2 cubic feet. The lifting power of this balloon is only 156.2 pounds, about one fifth of the total apparatus.

The skeptic will at once argue: "No wonder Oehmichen can rise from the ground with a balloon." But Oehmichen retorts: "The balloon is merely a stabilizer, a device to restore the equilibrium of the helicopter if it tilts too far. It is able to lift only one fifth of the total load. The rest is lifted by the propellers." In fact, Oehmichen intends to dispense with the balloon and use a smaller stabilizer.

A two-cylinder twenty-five horsepower 1910 motor drives the screws. Yet the power of the engine is more than sufficient because the screws absorbed only seventeen horsepower. The helicopter in test flights has risen to a height of nine feet.



A balloon on a helicopter? But the inventor claims that it acts as a stabilizer, being capable of lifting only one fifth of the load, the balance being raised by the propellers



In this electrically driven device for loading, it is merely necessary to push the pieces of cargo into empty slings as they move into position

Endless Chains Load Ship

A DEVICE that rapidly elevates boxes, crates, loose barrels, and packed stuff to the necessary height to pass into a cargo-carrier at the wharves, and then conveys the goods to the ship and deposits them in the hold of the vessel, has been invented by P. G. Donald, of London, England.

The machine proper consists of a light structural steel frame, arranged to rest with one edge on the hatch coaming and with the other on the bulwark of the ship. The steel framing carries a series of rollers and gearing, by means of which two endless chains are supported and operated. These endless chains carry canvas slings between them in which the cargo is handled. These two chains are connected by cross traverses consisting of two tubes each, the inner one of which keeps the two chains in relative position while the outer tube is free on the inner one.

The conveyor is driven by an electric motor that may be operated by any suitable engine. Two chain drives, one on each side of the conveyor, are provided. The reason for having two chain drives instead of one is that the end driving spindle must not connect the upper sprocket wheels, in order to permit a free passage for the swings with their loads.

The loading of boxes or cases on this conveyor is an exceedingly simple matter, it being merely necessary to push successive pieces of cargo into the empty slings as they move into position to receive the pieces of freight.

This system of loading takes the place of a number of men, and performs the task with very little noise and very slight wear and tear or breakage to the goods as compared with the ordinary method of unloading by means of cranes, although the crane is still far from becoming obsolete.

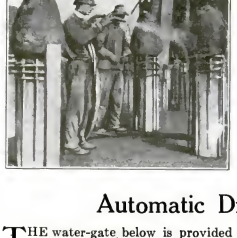
"Squirting" Concrete Piles

WITH a new process of making concrete piles, a core is first built with tar paper and wire netting. The tar paper is wrapped around a paper core. Over this is placed a layer of wire netting. The wooden core is removed, leaving a cylinder made up of the paper and the netting. This is set in place, ready to be covered with concrete. The cement-gun is used to cover the form with concrete. The concrete mixture is forced through a hose under a pressure of thirty pounds to the square inch.

The impact of the shot concrete gives a flintlike structure that is much more durable than poured concrete. After a heavy layer of concrete is squirted in place, the reinforcing rods are inserted and the squirting is continued until the correct diameter is attained.

This method of building up produces a stronger pile, since a hollow post is much stronger than a solid one

These molds are made of tar paper and wire; after the mixture is squirted on, they will be concrete piles

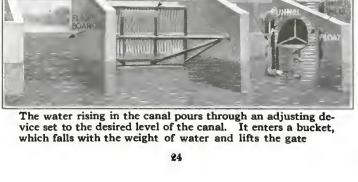


The mold partly covered, showing the reinforcing that is used between the first coat of concrete and the second

Automatic Drainage Gates

THE water-gate below is provided with a floating bucket, which fills as the water in the canal rises. This causes it to drop, and as it does so the "sheaves," or large iron pulleys over which cables pass, rotate a steel bar to which other pulleys are attached. Cables passing over these sheaves are tied to the metal drainage gate, and it rises automatically. This permits the surplus water to flow down into the main irrigating canal, where it is carried away.

The device can be fixed to any canal, and flooding from cloudbursts, or from the collapse of the banks of a lateral ditch, is amply provided for. Each gate in the canal which is not equipped with this device must be opened by hand by the ditch tender.



The water rising in the canal pours through an adjusting device set to the desired level of the canal. It enters a bucket, which falls with the weight of water and lifts the gate

Inflammable Tubes for Fire Protection

FIRE protection can be easily secured by an improved tube device of inflammable material.

Put tubes in all dangerous places, and connect them by piping to a main tank that holds a fire-extinguishing liquid. When fire breaks out, the tube will burn, and down will come the liquid, putting the fire out.

The Scientific Divining-Rod

THE bent old man with a divining-rod in his hand has long been a fascinating figure both in fiction and in real life. He is supposed to have mysterious powers that cause the rod to bend when it is held over water or metal deposits, and thus indicates where they are located.

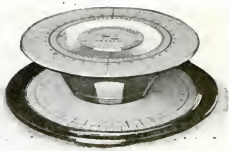
Among those who believe that metal and water can be "divined" from aboveground is Mr. B. Jirotka, a German engineer; he does not believe, however, that mysterious powers are necessary. In fact, he has invented an instrument which, he claims, will detect the radiation automatically.

This instrument consists of a glass bowl into which some liquid—alcohol, acetone, or acetic ether—is poured. A glass or wooden needle is floated on the surface of the liquid, and one end of it is attached to a metal rod that is fastened to the glass lid of the bowl. This lid, which hermetically seals the bowl, has a projecting edge that is graduated.

Mr. Jirotka claims that when metal

This instrument, according to Mr. Jirotka, the inventor of it, can detect water and metal in the ground; in other words, it is a mechanical "divining-rod"

is placed on the edge of this lid the needle within will be repelled; ores, coal, loose quartz sand, chalky spar, and kerosene also repel the needle. The action is not instantaneous, but occurs after a few minutes. Different materials will affect the needle differently. Sometimes the radiation is



The "rod" consists of a glass bowl filled with alcohol in which floats a sensitive wooden needle

strong enough to turn the needle around through 180 degrees, thus bringing it opposite the material.

Water and moist earth, says Mr. Jirotka, have the opposite effect on the needle; they attract it. So do certain salts. And the colder these attractive things are, the greater the attraction; whereas the colder the repelling things are, the less the attraction.

But all these claims of what is declared to be a new radiation, must be verified by a scientific investigation before being accepted by scientists and the public at large.

He Opens His Suitcase and Takes Out—an Inflatable Boat

Leaving the suitcase on shore, he goes out in his boat; he stops paddling occasionally to pump up the side bags

After a trip the bags are deflated; then the boat is taken apart and put back in the suitcase

The boat is being put together for another trip. After the bags are pumped up, they are attached to a wooden frame

No larger than an ordinary suitcase is the one that holds the collapsible boat. Its contents are not heavy

Staging a Realistic Naval Battle

In which the audience sees a huge cruiser explode and sink

By Philip Schwarzbach

"ALMA" is the stage name of the French cruiser that is the victim of German treachery in the dramatic play "In the Night Watch." As the curtain goes up for the first time, you see the deck of the *Alma* gaily decorated with Japanese lanterns; you hear music; there's a dance on board. Among those present are the captain, his wife, and two designing officers. Thus the eternal triangle is turned into a rectangle.

The captain receives a wireless message: "War with Germany has been declared." For the sake of his wife he tells the guests that peace is assured.

He soon sends them to shore, however, and immediately tells his men the truth. The decks are stripped for action and the vessel moves. As the curtain falls you have an uneasy feeling that the captain's wife, who is in love with one of the officers, is still on board. You discover later that you were right.

And now for the battle. In the second act you see the *Alma* riding the waves. A strange ship is sighted. Our hero, the captain, orders secret signals to be flashed. The strange ship gives the correct reply; this is repeated several times as the mysterious ship approaches. You see the ship turn about. Then the lights go out. Instantly the firing begins. The *Alma* returns shot for shot. Suddenly she is fatally hit by a torpedo. The captain is wounded, but he carries on, ordering the life-boats to be launched. The semi-villain with whom the captain's wife is in love turns hero and straps his own life-belt around the wounded captain.

Next you see the actual sinking. As the huge ship takes her final plunge the boilers burst and steam roars upward. Gradually the steam disappears, and you see a small life-boat in the distance. And its passengers? A man and a woman.

And now comes the last act—the court martial. The only known survivors of the *Alma* are the captain, the real villain, and the sailor who attended the villain-hero. The captain is unable to prove that the enemy ship answered his signals correctly. The villain denies having seen them, and then at the crucial moment the penitent wife appears and it all ends happily.

The *Alma* is nothing but a well painted piece of canvas mounted on a wooden frame. It slides down through a slot in the floor. A shotgun and escaping steam imitate the explosion of the ship's boilers

Here you see the back of the enemy ship as it first appears on the horizon. It is mounted on a pedestal and is operated by one man. He pushes it slowly across the floor to give the effect of an approaching ship.

When the stage-manager first flashes the cue light, the man behind the ship presses a button that controls the answering signal to the French ship. All the other operations—signals and flashes as the shots are fired—are handled in the same way. The stage-manager has his cue booth at the side of the stage in front

As the enemy vessel appears to approach, a larger ship is substituted for the small one. This larger ship is made in three sections—bow, stern and midship. Each section is mounted in a groove and is controlled by a rope that winds around a windlass. The midship section has a red and a green light at each end. The red shows first. When the ship appears to be turning around, the bow and stern section are telescoped behind the midship section and the lights are changed from red to green and red. Then as the telescoping sections are extended again the green light shows

The explosions that shake the vessels—and also the theater—are made by discharging large-caliber shotguns into barrels. The stage-manager, again, is responsible for giving the cues

Torpedoing a Stage Cruiser

Above you see what is going on behind the scenes when the cruiser *Alma* meets the enemy ship. The *Alma*—or rather the small part of her that the audience sees—is mounted on rockers. Several men work together, pulling the end of the rockers up and down, thus giving the effect of a ship riding rough waves. The waves, by the way, are made by playing "ripple light" on three small drops located between the *Alma* and the enemy ship. These drops vary in height, and are topped by wire that makes them blend.

Clouds that move across the sky throughout the first act are made by a light-machine in a similar manner

Spraying the Chicken-Coops to Kill Mites

CHICKENS infested with mites or other parasites are not good layers. Eternal vigilance is the price of a good egg crop.

The diminutive sprayer, penetrating the corners and crevices of an infested poultry-house, is effective where only a small flock of chickens is maintained. The spraying is done at varying angles in all the corners of the poultry-house, and then the weapon is directed to the floor. The roosts must be taken down and boards and boxes removed.

Crude petroleum is effective in the eradication of chicken pests, the insecticide consisting of one part of kerosene to four parts of crude oil.

Rock and Keep Cool

ON a very hot summer day, the mere exertion of rocking will make you uncomfortably warm. One inventor decided that he was going to enjoy rocking and yet remain cool; so he made a fan operated by the motion of the rocker.

The movement of the chair causes a large gear wheel to revolve. Meshing with this large gear is a pinion. A fan is mounted on the shaft with the pinion, and this is set into motion when the chair is rocked. A delightfully cool breeze results and the comfort of rocking can be enjoyed however hard old Sol tries to heat up your part of this planet.

Holding Up the Box-Cover

PROVING that simple patents pay well, we illustrate one that has made money for its inventor.

This is a holder for the cigar-box. It is so made that it fits over the back and side of the box. Extending from the lower section is a small wire. When the box is opened this wire springs into place against the cover and holds it open.

The cigar clerk will tell you that it helps him in the day's work.

The Man of Bulak

THE wooden image in the picture below is not unlike some of the men you see to-day; and yet, that image was made centuries ago. Men have not changed much with the times.

The statue is known as "The Man of Bulak," and is now in a museum in Cairo. It is supposed to represent a village chief and it dates back to prehistoric times. The even temperature and the dry climate in northern Egypt have helped to preserve it.

Many archæologists believe this to be the oldest statue in existence.

Comb the Cranberry Bushes for Efficiency

HERE is a quick way of taking cranberries from the bushes. Comb them off. The device used is both a comb and a scoop. The comb takes the berries from the vines and the scoop holds them.

It is not long since berries were picked entirely by hand—a slow, costly job. Then came the comb and more speed.

If the scoop is used carefully, the berry bushes will not be injured in the least.

Instructors Travel to Students

IF plans of Hawaiian educators are carried out, pupils will have their education brought to their very door. Application for a Pan-American university charter has been made, with "classrooms" in the pineapple and sugar fields throughout the territory of Hawaii.

The first work of the kind is to be carried on in the labor camps of the islands.

Steel for the Concrete Road

BOARDS used to be used as forms for road concrete. They were unsatisfactory in every way. They would warp, leak, and break, causing imperfections in the road. Then came the steel forms—real helps and time-savers.

The steel forms may be put in place in a short time.

They are automatically attached to pedestal supports, which are held to the ground by steel stakes. The steel forms hold their shape and they may be used over and over again.

This Heel Rotates When You Walk

MOST of us wear down the heels of our shoes unevenly and this gives us an untidy appearance. Hence it behooves us all to wear revolving rubber heels like the one below, which will give your shoes a much longer life.

These heels are constantly in motion when you walk, and in consequence they wear slowly and uniformly.

Such a heel is screwed through the center to the leather heel of the shoe, being attached in such a way that it coincides exactly with the sides of the heel.

It is claimed that the heel will not skid in the rainiest of weather.

Two Very Different Members of the Horse Family

THE difference between a pony and a horse is the size—and sometimes this difference is very great. In fact, some ponies are so small that they can walk between a horse's legs without bumping.

The pony shown in the picture below is the smallest of them all; hence, he has gone into the theatrical business. He and his partner, the big white horse, are under the management of the woman who stands by.

Once upon a time there was a five-toed horse—the ancestor of the modern horse. He was not much bigger than a dog, so that there is nothing scientifically new about the pony pictured.

This pony is clearly not a reversion to type, but merely a freak of nature, probably caused by some defect in the parents.

Putting the Porch on Top

IN California an architect has overtopped convention and built a house with an attractive porch on the roof.

After all, what is a porch for? It is a place where family and friends can gather at leisure hours, or in the quiet of the evening. It should be a cool place, if the house is built in a warm locality.

From the higher levels of the structure a better view can be obtained, and if a breeze is stirring, one will surely get it better from the roof than from the ground.

This particular roof-porch adds greatly to the charm of the design of the house.

Artificial Wool a Failure

ALTHOUGH the director of the chemico-physical section of the Research Institute for the Textile Industry at Dresden personally supervised experiments toward artificial wool, he has pronounced his efforts a failure.

The process consisted of compressing wool scraps otherwise worthless—short fibers, ends, shreds, etc.—after treating them with certain chemical solutions. It was found that on putting this wool in solution it decomposed.

An Emerald that Weighs Four Ounces

A BLOCK of wood—that's what you think the band below is bolding; it's too regular to be a stone and too large to be a jewel. But it is a jewel; an uncut emerald weighing six hundred and thirty carats, or about four ounces. It measures two and five eighths inches from end to end.

This is said to be the largest emerald mined since the days when Cortes invaded Mexico; however, it is not nearly so heavy as some emeralds in existence. In Bogotá there is a thousand-carat emerald.

The new emerald is to be cut up into small stones.

Put a Sieve on the End of the Watering-Hose

NEXT time you spray the garden, notice the shape the water takes as it leaves the nozzle. You will see that it is hollow and cone-shaped. Centrifugal force may be blamed for the hollowness.

A full spray would be better for the flowers and plants, and now there is a device that, when attached to the nozzle, will produce this. It is a small flat wire sieve mounted on a holder that keeps it at a distance of about two inches from the nozzle. When the whirling spray shoots out of the nozzle, it hits the sieve, is broken up, and continues on its journey as if it were coming out of a watering-can, and in addition waters more plants as it sprays, albeit the water falls more gently.

Joseph W. Burbank, of Albany, New York, is the inventor.

Ice Bought by Slot-Machine

IN the illustration above is shown a machine for ordering ice.

The housewife decides the amount of ice that will be needed for the day. Going to the little slot-machine that hangs on the porch wall, she slips a coin or a ticket in the slot, then unlocks an indicator that tells how much ice is wanted.

Along comes the iceman, fills the order, unlocks the box containing the coin or ticket, which action automatically withdraws the indicator, and by pushing down a knob at the top of the machine he locks it, leaving it ready for the next order.

Where Fish Is Cleaned on the Pier

FISHERMEN who catch fish from the pier at Santa Monica, California, need not worry about the cleaning of the catch when they arrive home. No more will there be that domestic lecture that removes all of the joy from a perfect fishing day.

This Pacific coast city has equipped its pier with running water and sinks for fishermen who wish to clean their fish where it is made most convenient. What fisherman would not gladly clean his catch in such comfort—not mentioning the view?

Such considerations cause residents to feel justly proud of their community and take an interest in its welfare and public events.

His Right Hind Leg Is of Wood

ONCE there was a dog, and it had a wooden leg. This is not a fable, but an actual fact.

The dog was run over by an automobile, and one of its hind legs had to be amputated.

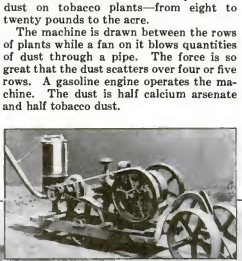
A three-legged dog doesn't stand much chance in this world; hence the dog's kind mistress had a fourth leg made for it. In a very short time the dog learned to use it deftly.

The wooden leg is covered with white cloth, and is, alas, very conspicuous, since the dog's hair is grayish brown.

Killing the Flea-Beetle

CHIEF enemy of tobacco-growers is the flea-beetle. In one season it did six hundred dollars' worth of damage an acre in the tobacco fields of Florida. Now there is a machine that scatters poisonous dust on tobacco plants—from eight to twenty pounds to the acre.

The machine is drawn between the rows of plants while a fan on it blows quantities of dust through a pipe. The force is so great that the dust scatters over four or five rows. A gasoline engine operates the machine. The dust is half calcium arsenate and half tobacco dust.



Megaphone, Fan, and Hat

HARD it is to imagine anything that will recommend itself more readily to the heart of the confirmed football, baseball, or basketball rooter than this three-in-one megaphone. Should your team be winning, the megaphone will carry your joy to the field. Should they be losing, it will convey encouragement.

But that is not all. During the intermission the same megaphone, folded, becomes a fan to cool the fevered brow of the enthusiast. The game won, the megaphone becomes a hat.

How a Road Was Saved by Jacking It Up

AFTER heavy rains had washed out the sandy subgrade of a section of highway in New Mexico, leaving the concrete slabs with but frail support, an engineer of the Bureau of Public Roads quickly adopted the novel procedure of jacking up the roadbed, and rammed wet sand into the dugouts to support the concrete slabs.

The collapse of the pavement was averted, and the concrete slabs were restored to their former bed without crack or flaw. Until the sandy subgrade could be rebuilt the washed shoulders of the road were protected with brush as a precaution against another gully-washing rain. The gaps in the subgrade were rapidly refilled.

Fattening Chickens by Machine

FAT chickens command higher prices than lean chickens. Chicken breeders who supply broilers and roasters for the market know this, and are not willing to leave the fattening of their chickens to chance.

To prevent the bird from using up fat by exercise, it is kept in a coop so small that it has practically no room for exercise. To expedite the fattening process the birds are forcibly fed by machine. One man holds the chicken while another presses down a lever and forces a quantity of the food contained in a tank through a rubber tube into the mouth of the chicken.

The birds are thus fed three times a day, the quantity of food forced into them depending upon their condition, age, and other factors.

Towers Made of Turtles and Spools

TURTLES are not acrobats by nature. Their clumsy hard shells make it impossible for them to twist and turn with ease. A London shopkeeper took advantage of this fact and placed in his window the three turtle towers shown above.

Spools of various sizes support the startled turtles in air. The larger animals are placed at the bottom and the smaller ones become upper stories. No matter how madly they wave their feet in the air, nothing happens to the towers; the shells are so hard and firm that they are not unbalanced by the motion of the feet.

How does the shopkeeper feed his prisoners? Unless he releases them at mealtime, he must give them individual service, feeding them one by one.

Protection from the Live Wires by Special Apparatus

DEATH lurks in these wires. The men are repairing live wires. They call them "hot." When they are "hot," they are dangerous, and the lineman must watch his step and his hand.

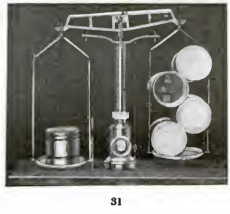
The platform is insulated so that it helps the lineman to keep safe. A wooden shield is also placed over the wire so that accidental contact through slipping or falling is remote.

The flat form and the wooden supports are made of a moisture-proof wood that is a fairly good insulator of electricity.

Metal Lighter than Aluminum

MAGNESIUM is an extremely light metal and it has little mechanical strength. It is about one third lighter than aluminum.

The metallurgist has succeeded in alloying this cousin of aluminum with other metals that impart to it the proper degree of tensile strength. The resulting alloy is, however, ninety per cent magnesium. This makes it a very light alloy with ideal physical properties. It machines nicely, has a low coefficient of expansion, is tough, hard, and well able to resist wear.



Cook with Gas in Camp

THOSE who have gone camping with a smoky oil-stove or an alcohol lamp will appreciate the convenience of this little acetylene burner.

The coffee-pot in the picture above suggests breakfast, with flapjacks on the side. The little cooking outfit, however, is equally useful for preparing other meals, and one can imagine very good soups and sauces.

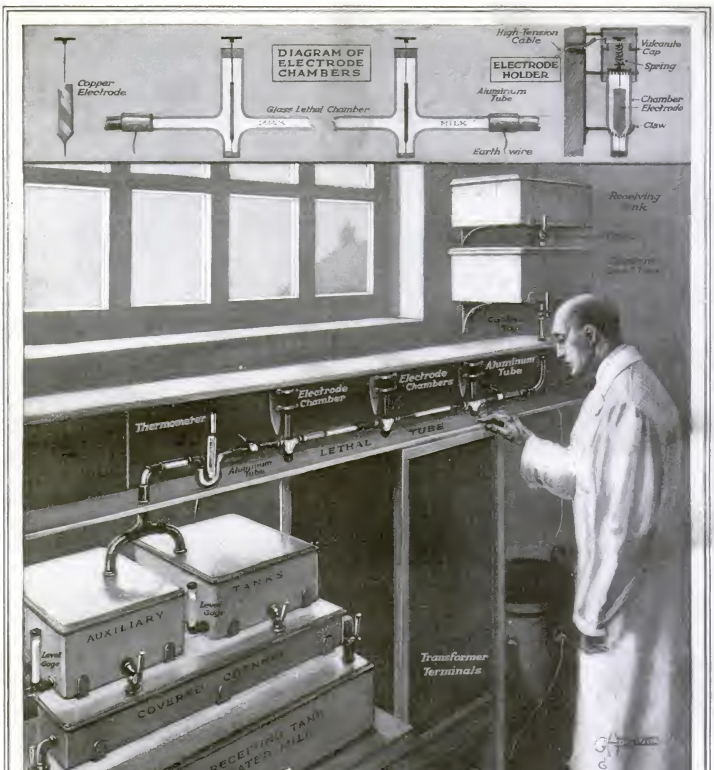
The acetylene burner is just as practical as the gas-stove at home. The gas is carried under high pressure in a small tank, and the supply is sufficient to cook many meals.

The tank is light and portable and the entire outfit does not weigh as much as a supply of oil or alcohol that would last the same length of time.

Could You Assemble These Parts into a Box?

CONSTRUCTING a square box is usually a simple matter. Here is a box that, although all the parts are finished, it is almost impossible to assemble. The box has been in existence in an English family for more than a hundred years, and is said to be the only box of its kind in existence, and yet very few people have ever been able to put it together; and some of them have worked on it for months.

Of course the box is elaborate in construction. There are twenty-four edge pieces that must be properly joined together, and it is there that the difficulty lies, since the sides, top, and bottom logically fall into place.



Drawing by G. A. Davis

The Wonderful New Process that Kills the Germs in Milk

Whereas sterilization by pasteurizing milk is often non-effective, recent experiments by three British scientists seem to prove that electricity solves the problem. Samples of milk treated electrically, taken on fifteen successive days, failed to disclose any trace of typhoid germs; and milk that had been infected with tubercular germs was also cleared by electricity.

The picture shows how the apparatus for electrically treating milk works. A tank receives the raw milk, and this is connected by a pipe with a constant-level tank, which maintains a uniform pressure. From this the milk is led to the "lethal tube," a section of which is glass, with intermediate electrode chambers. As the milk passes out of this tube, its temperature is registered by a thermometer, after which it flows into the auxiliary tanks. These are alternately filled and discharged into a covered channel, which in turn discharges into the tank for treated milk. These tanks might be called "safety" tanks, since, in case of a mishap to the apparatus, such as failure of the electric supply, the untreated milk may be returned to the overhead tank for re-treatment.

Electric sterilization destroys not only typhoid and tubercular germs, but also those that are harmless. There is naturally some question as to whether it is wise to deprive milk of a property that is not yet thoroughly understood

Electricity to Keep Milk Fresh for Weeks

Three English scientists discover a new sterilization process

By P. J. Risdon

English correspondent of the Popular Science Monthly

MILK is pasteurized by heating it. The object is to destroy injurious bacteria that cause typhoid fever and tuberculosis. Unless these bacteria are all killed, the survivors multiply at a rate beyond belief, and the risk to the consumer is proportionately enhanced.

Now, whereas present methods of sterilization fail to effect complete extermination of typhoid germs, it has proved beyond question that it can be secured by electric treatment.

A series of interesting experiments has been carried out by Professors J. M. Beattie and F. C. Lewis, of Liverpool University, and Professor Leith at Birmingham, which may possibly revolutionize the present methods of sterilizing milk. Although their experiments have not reached a final stage, the importance of the results can scarcely be exaggerated.

Among other instances and proofs, samples, taken on fifteen successive days, of electrically treated "control" milk failed to disclose any trace of typhoid germs. Milk from tubercular cows and milk deliberately and heavily infected with tubercular germs have also been entirely cleared, proving that the destruction of injurious bacteria was complete. In other tests guinea-pigs were inoculated with electrically treated and untreated infected milk. Those inoculated with unsterilized milk developed tuberculosis; those inoculated with electrically treated milk remained perfectly healthy.

Milk Kept Sweet for Two Weeks

In addition to destroying the germs of typhoid and tuberculosis, electric treatment destroys 99.9 per cent of harmless bacteria. Milk so treated, especially if rapidly cooled, can be kept in an ordinary room at ordinary temperatures for several days without deterioration. In one or two instances it has remained sweet for a fortnight. All the other essential ingredients of the milk, such as fat, sugar, etc., remain unaltered in quantity and quality.

An important feature of the electrical process is the practical character of the apparatus employed.

As the picture on the opposite page shows, the apparatus comprises a tank for receiving untreated milk, connected by a pipe and tap to a constant level tank. The latter is fitted with a ball valve, which maintains a uniform head or pressure. A pipe with a control tap leads downward to the "lethal tube." Short sections of aluminum tube are introduced for "earthing" purposes. A section of the lethal tube is of glass, with intermediate electrode chambers. As the milk passes out of the lethal tube, its temperature is registered by thermometer, after which it flows into auxiliary tanks. These tanks are alternately filled and discharged into a covered channel, which in turn discharges into the main receiving tank for treated milk. The object of the two auxiliary receiving tanks is that, in the event of mishap, such as failure of the electric supply or the accidental switching off of the current, untreated milk may be prevented from entering the main receiving tank and may be returned to the overhead tank for subsequent treatment, while the auxiliary tank is sterilized.

The diagram of the electrical apparatus is almost self-explanatory. The transformer is for raising the voltage of an ordinary low-pressure supply current, and the aluminum tubes are for "earthing" purposes. As the milk flows through the lethal tube the high-pressure electric current passes into it from the electrodes, out through the aluminum tubes to the earthing plate, the earthing arrangements being necessary for the protection of the operators. Thus every portion of the milk as it flows through the lethal chamber is equally exposed to the influence of the current for a matter of some fifteen or sixteen seconds.

At the top of page 32 is an enlarged view of the copper electrodes and electrode chambers. All contact surfaces are encased in vulcanite.

Many experiments were necessary to ascertain the exact class and strength of current, the diameter and length of tube required, and the quantity and rate of flow of the milk, as all these things must be correctly proportioned. The plant at Liverpool, which for three months treated the milk for the Liverpool Corporation infant-welfare centers, had a capacity of 30 gallons of milk an hour. An alternating current of about 4000 volts and 2 amperes was employed, which raised the temperature of the milk to 63-64° C. (148° F.). This voltage and temperature proved the most satisfactory; it is sufficient to destroy all harmful bacteria and 99.9 per cent of other bacteria. A temperature of 70° C. was tried, but was found to effect undesirable chemical changes. Moreover, too much current was consumed.

Should All Bacteria Be Destroyed?

Direct current was experimented with, but gave no satisfactory results.

When starting up the plant, the milk is allowed to escape for a few minutes until everything is working correctly. Then the outflow is diverted into the auxiliary receiving tanks and the escaped portion is returned to an overhead tank.

A refrigerating plant is an almost essential adjunct. It has been found that, by rapidly cooling the milk after electric treatment, it remains sweet for a longer period.

Skilful supervision and scrupulous cleanliness are of course essential, both during sterilization and in the subsequent handling of milk.

The question arises: Is it advisable to destroy admittedly harmless bacteria that presumably give milk "live" qualities that Nature has decreed it shall possess? It seems indeed to open up a prospect for synthetic milk. One cannot help wishing that means could be devised for destroying harmful germs without depriving milk of a property that is not fully understood.

Must Pasteurizing Go?

SCIENTISTS long ago convinced legislators and the public of the necessity of sterilizing milk to destroy the germs that flourish in it. Unless it kills all the germs, sterilization by the usual method—pasteurization—has the terrible effect of speeding up their multiplication.

Recently three British scientists made experiments in sterilizing milk electrically, and the results may completely revolutionize the present method.

Bowling the Jack on the Green

The game introduced on New York's Bowling Green in 1732 has lately been revived in several American cities

By Philip Schwarzbach

"NEXT stop, Bowling Green!"

Few of the passengers who hear the New York subway guard shout out this station, know or even wonder why the comparatively small patch of grass at which the train will stop is called "Bowling Green."

That patch received its name in the year 1732, when three men — John Chamber, Peter Bayard, and Peter Jay—leased it for the large sum of one peppercorn a year. They fenced it in, laid it out, and bowled on it regularly. In those days bowling was done outdoors in fair warm weather, and indoor alleys were used in the wintertime only. Now, however, there are very few bowling-greens in this country; but the old outdoor game of bowls is still played in New York city by enthusiasts.

To-day the Bowling Green section of New York city is crowded with skyscrapers; but in 1760 it was a real bowling-green, as this old print shows

Outdoor bowling is very different from the indoor sport.

A full-sized bowling-green is one hundred and twenty-six feet square, and it is divided into six or eight rinks. A shallow ditch fourteen inches wide surrounds the green, and beyond the ditch there is an embankment two and one half feet high.

Instead of ten pins, a single "jack" is used. This jack is a white earthenware ball, two inches in diameter. The opposing players, or teams, toss up, and the winner stands on the mat at one end of the first rink. He hurls the jack down the green. When it has stopped rolling, it is placed in the center of the green at that point—provided it is at least seventy-five feet from the mat. Should the jack roll into the ditch, it is placed six feet from the edge. Then the bowling begins.

The players try to hurl their balls—or bowls, as they are called—as near to the jack as possible. If there are several players on each side, the first players must be careful not to block up the passage and thereby hinder their partners. Four men usually play on each team, the captain of the team being the last one to hurl. Each man hurls two bowls on each rink. When the playing is finished on one rink and the score computed, the players move on to the next. Twenty-one ends are a game.

Each man on a team must be trained to use different tactics. The first man up must be a good judge of distance, and must hurl his bowl so that it lands very near the jack. The last man up may be called upon to trail the jack back to where his partners' bowls are. This requires a keen eye and a steady hand.

Very often the entire game depends on the placing of the jack. Recently a Canadian team played in England, where the greens are longer than those in Canada. Whenever an Englishman hurled the jack he sent it so far down the green that the Canadians were unable to score. It was because of this skilful jack-placing that the Canadians lost most of their games.

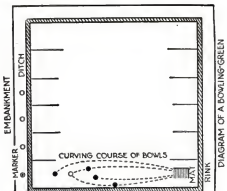
As for the bowls themselves, they are not perfectly round, as in the case of the indoor bowl. Instead, they are more rounded on one side than on the other; hence they follow a curved path up the rink.

The first bowls made were of stone, but they proved to be too heavy and not swift enough. They were replaced by wooden bowls that were weighted down to give the proper bias. Now, however, this is accomplished by the peculiar way in which the wood is turned. There is a number indicating the degree of curvature painted on the side of each bowl. If the bowl is held so that the number is near

The last shot has just been fired. In order to save his team from defeat, he was forced to trail the jack back to where his partners' bowls were

The team whose players roll their bowls nearest to the small white jack wins

After the jack is placed, the players go to the mat in turn, and bowl



A full-sized bowling-green is 126 feet square, divided into six or eight rinks. A shallow ditch surrounds the green, and beyond that an embankment

the little finger of the hand, it will curve toward the right side of the rink; when the number is near the thumb, the bowl will curve to the left. However, the path that the bowl follows depends largely on the skill of the player.

The pictures shown on these two pages were taken recently at the bowling-green in Prospect Park, Brooklyn, New York. The game has also been revived in Boston, Detroit, Buffalo, Hartford, Pawtucket, and in a large number of villages along the Canadian border.

When did the game first appear in history? Herodotus mentions the fact that the Lydians bowled strenuously

The wooden bowl that is used. One half of it is rounder than the other, so that when the bowl is released, it follows a curved path

when food was scarce. It made them forget their hunger. Again, at the time of the Spanish Armada, bowling was the fad. Sir Francis Drake, it appears, was bowling at the time the Spanish Armada was sighted off Cornwall.

When the news was brought to him, he said: "There is plenty of time both to win the game and beat the Spaniards."

Even John Calvin, the celebrated theologian, is reported to have played a quiet game of bowls on a Sunday afternoon! John Knox—tradition has it—discovered him in the act one time at Geneva.

Sir Isaac Newton was another bowling enthusiast. His niece wrote of him:

"In the warmest pursuit of his discoveries he, going out, left a candle upon his table amongst his papers; he went down into the bowling-green of Trinity College, Cambridge, and meeting somebody who diverted him from returning as he intended, the candle set fire to his papers and he could never recover them."

Water "Pumped" with an Endless Belt

THE ingenious French engineer, Canuelle, has made a revolutionary step forward in the art of lifting water to a higher level. No pump, air pressure, vacuum, buckets, or pipes are used. Advantage is taken of the property of liquids known as surface tension.

It is surface tension that allows us to fill a glass with water above the rim without overflowing, and surface tension that enables an insect to skate on water without wetting itself.

What is surface tension? A sort of intangible "skin."

Now, let us see how this new "pump" works. A strip of thin metal is bent to form little cells, as shown in the picture. This is made similar to the way one would take a strip of paper and bend it first in one direction and then in the other. The bending is, of course, done by machine. Rivets hold the bent metal strip to an endless leather belt. The belt is arranged over two pulleys, one being submerged in the water to be lifted. The other pulley is driven by hand or motor.

As the belt passes under the surface of the water, the little cells are filled. When these are lifted above the surface of the water, surface tension prevents the water from flowing out. When the rapidly moving belt with its water-filled cells suddenly swings around the top pulley, centrifugal force ruptures the surface film and the water is thrown off into whatever receptacle is used.

The size of the cells must not be too large, since surface tension will be effective only with small areas. If a larger quantity of water is required, another row of cells is added to the first row; even several rows can be added.

An endless belt with small metal cells attached to its surface forms the lifting element of this unique "pump"; the principle upon which it works is known as "surface tension"

Repairing a Hydraulic Elevator Pump

ONE of the elevators in a New York skyscraper was recently put out of commission by the breaking of a hydraulic pump casting. On examination it was found that the metal casing was badly cracked in four places, the breaks penetrating clear through the shell, and extending five or six inches.

The damage was so serious that it was thought an entirely new casting would be required. When it was found, however, that replacement would cost eighteen hundred dollars, and that it could not be done without serious delay, an oxyacetylene-welding firm was consulted. On reporting favorably, the welders were put to work.

The chief problem was ventilation. The repair had to be made in the pump room and was one requiring thorough preheating. The pump occupied a space in the basement under the elevator shaft, where, if special ventilation were not provided, the gases from the charcoal would seriously affect the welder. This difficulty was overcome by connecting the building's ventilating apparatus so that it drew off the fumes. The cramped space in which the work had to be carried out also made it difficult.

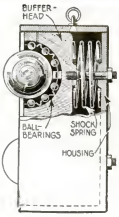
The actual time of the job, including preheating and welding, was sixteen hours—two welders working in relay. Approximately thirty pounds of welding-rods were used in filling in and building up the welds. The casting, after repair, was subjected to one hundred and sixty pounds per square inch working pressure, and is to-day as good as new.

Taking the Shock Out of Docking

NO matter how careful or experienced a ship pilot may be, it is impossible to dock a large vessel—or a small one, for that matter—without striking and rubbing the dock. This causes damage to both the dock and the vessel. In the case of a big, heavy vessel, the dock is apt to be displaced several inches, and if every vessel that docks causes a like amount of displacement, it will not be long before great damage has been wrought. In striking and rubbing the dock, the ship also suffers strains that will in time necessitate a trip to the drydock.

This is the way in which Lee Larsen, an inventor, would eliminate the trouble of docking. He would place huge ball-bearings along the edge of the dock. These large ball-bearings would rest against smaller ones in such a manner that the larger bearing would revolve with very little friction. When the ship's side came in contact with the ball-bearings, friction would be practically nil. The shock of the impact would be absorbed by heavy springs mounted at the back of each ball-bearing. Rising tides may come and go, winds may blow, and the pilot may get just a bit careless; but neither the ship nor the dock will suffer in the least when these dock "bumpers" are in use.

The spring bumper saves both the ship and the dock from damage through rubbing and bumping. Here it is in use



This shows the construction of the bumper as it is applied to docks. The big spring is similar to those used on railroad cars

This spring bumper would be a great help to the ferry-boat pilots. If the slip was provided with such attachments, they would save the boat and the piling from damage. In rivers where a swift current is flowing, it is a very difficult matter to pull a big heavy ferry-boat into the slip without striking the piling. With the ball-spring bumpers a boat could strike the piling without any great danger, since it would merely glide off instead of swinging over to the other side of the slip as it does now.

There is no reason why a vessel could not be equipped with these spring bumpers instead of having them placed on the docks. A vessel so equipped could stop at any pier or dock without danger of accident.

The cost of making such an attachment would not be prohibitive and it would soon pay for itself in the money that would be saved in repairs to the ship and damage to the docks.

This Instrument Plants Hair

GARDENERS lacerate the soil of a barren plot, insert some seeds, take a sprinkling-pot, and with a little care bring forth an abundance of soft green grass to delight the eye. According to a record from the patent office, attempts are ever being made to make the desert of a bald head blossom with a crop of new hair. Have any of these patents special merit? Is the task of growing hair as easy as that of raising grass on the lawn?

The nearest analogy is that of an instrument constructed for the purpose of planting hair in the human scalp. The hair, after being sterilized, is placed in a tube and mechanically guided into the part of the instrument that feeds it into the skin.

A part of the operation less appealing to the timorous is the method by which the hair is inserted in the scalp.

The apparatus has an implement provided with means for puncturing the skin, spreading the punctured opening sufficiently to admit insertion of the hair, retracting the puncturing needle, and severing the inserted section from the main hair section.

In general, a less brave person might submit to a genuine old-fashioned scalping by Indians, were it not for the fact that in one case he is promised a better-looking appearance by the addition of a head of hair, while in the other he is deprived entirely of this acquisition to his vanity, not to mention the loss of his life, liberty, and the pursuit of happiness.

A promising hair-planting instrument. As it moves along the bald head it makes minute openings in the skin, while hair is thus automatically "planted"

This instrument is just as effective—perhaps a little more so—on scalps absolutely bald as it is on those partially so

An Earthquake to Order

THERE was a flare on the crest of the volcano. A red destruction poured through the forests, the earth shook violently, and the seething lava trickled down the hillsides. Great cracks opened in the earth, swallowing men and women. Buildings staggered and fell in clouds of dust, and crimson tongues of flame burst through the blackness of the night.

Then all was quiet—until the director shouted: "Great! That was a whale of a job!" Excited actors and actresses then started to dig themselves out, the "red flare on the volcano" was extinguished, and the "seething lava" was turned off.

The story, "The Fire Cat," a romance of South America, filmed by the Universal Company, required that a town be demolished by an earthquake and then flooded with lava from a volcano.

To produce the earthquake the "movie" engineers cut a jagged slice in the earth a quarter of a mile long and ten feet deep. Under ten equally divided sections of one side of the slice were placed sliding platforms. At this stage of the excavation, the result might be visualized as folding doors, placed flat on the ground with ten feet of earth piled on each door. The ten sliding platforms were then attached to ten powerful motor-trucks by concealed cables. The ten trucks were lined up evenly, each attached to one sliding platform by just enough cable to be out of camera range. With motors running, the trucks waited for the word from the director.

As the camera clicked, the trucks leaped forward, pulling the crack in the earth apart with an effect exactly like an earthquake fissure.

At that moment a mountain-top in the background roared, and the sky was bombarded with rock, which fell on the scene in a genuinely dangerous barrage.

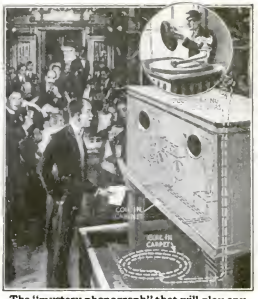
The volcanic eruption was produced by dynamite. The peak of a high hill on Universal City property was drilled in twenty places and packed with dynamite. To give the effect of lava, fifteen concealed sets of fire hose pumped scalding muddy water from the far side of the peak to roll in torrents down the side toward the camera. The dynamite was detonated by electricity. As the explosion hurled tons of rock and sand high into the air, the fire hose belched the dirty steaming water from their concealment.

To topple down the buildings nearest the earthquake crack a dozen yoke of oxen were hitched to the adobe structures, ten on each side. At a signal from the director, they were lashed into action, literally tearing the building apart.

This is one of the few instances where a movie director has been permitted to use artificial means to produce an effect.

The earth came near swallowing up the heroine, but, of course, the brave, fearless hero saved her from a horrible death. The trick of the earthquake is exposed below

This is how the motor-trucks were attached to the pieces of earth on the roller to produce the movie earthquake. It took a lot of hard work and a great deal of money to stage this scene



The "mystery phonograph" that will play any record requested by the host. The secret of the device is shown by the dotted lines

Ordering the Phonograph to Play What You Want

IMAGINE yourself standing in front of your phonograph giving it instructions to play certain selections and having it faithfully carry them out. Mr. Earl Hanson, a radio engineer of Washington, D. C., has made this possible.

The phonograph that does the playing is located in the garage or another part of the house. It is provided with heavy current telephone transmitters that are attached to the tone arm. These transmitters are connected to a coil of wire placed under the carpet beneath the "dummy" phonograph located in the room occupied by the guests. Another coil is arranged in the dummy phonograph. This second coil is connected to the necessary amplifiers and receivers. When a record is played in the garage, the voice-carrying currents surge through the coil under the carpet beneath the phonograph. The coil in the phonograph receives these voice currents inductively, and they project into the room.

When the host instructs the phonograph to play a certain record, his voice is carried out to the garage in the same way that the music is carried to the guest-room. The person in charge of the actual playing hears the request and puts the proper record in place. To prove there is no "trick," the host tells his guests that they, too, may make a selection.

By adjusting the current strength in the circuits employed, the voice can be amplified to practically any strength.

Wrapping Six Hundred Loaves of Bread an Hour

With this new machine one person can do it

The first step is to place a loaf of bread upside down on a sheet of specially prepared waxed paper. As you will see later on, there is a reason for the six stripes that run lengthwise of it

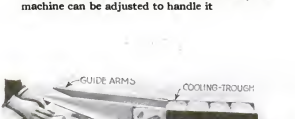
The ends of the paper are then folded over. And the stripes? They are porous and will supply the bread with sufficient air to prevent it from becoming moldy, and yet not enough to dry it out

After the folding, the bread is turned right side up. More about the stripes: Their number is varied according to the weather. In cold, dry weather two ventilating stripes; in summer sometimes twelve

When the folding has reached this stage, the loaf of bread is taken to the finishing machine. It passes between two electrically heated plates, which complete the folding and melt the waxed ends

The loaf is now ready to be passed into the cooling-trough to harden the wax. Whether it be a six-inch loaf or even a twelve-inch loaf, this machine can be adjusted to handle it

The cooling-trough is located behind the heating-plates. The loaves fit snugly against the sides of the trough; thus, as the wax congeals, it holds all the surfaces together



Here you see the entire machine—one loaf going in and one loaf dropping out. The floor of the cooling-trough is movable; one turn of the crank on the wheel near the heating-plates sends the end loaf on its journey to the ultimate consumer

Men Who Race Model Yachts

Just as exciting to these grown-up boys as an "America" cup race are their city park lake contests

When not in action on the lake in Prospect Park, Brooklyn, the yachts are placed in dry-dock inside the boathouse; each dry-dock consists of a cradle on wheels. There are about seventy-five yachts in the club at present

He's getting his yacht into the best possible position for crossing the line when the race starts. When the signal is given, the yachts are released and an official time-keeper on shore records the actual crossing time of each yacht

How is the actual sailing accomplished? The rudder is connected with the mainsail by a cord that is left loose when sailing against the wind. The tiller swings between two adjustable nuts. But when sailing before the wind the cord is kept taut with the rudder on the same side as the mainsail

Before a yacht is entered in a race it is carefully measured by the official measurer of the club. It is placed in a tank filled with water in order to determine the water-line. Length over all, sail area, and other racing details are also carefully recorded

As the yachts sail through the water, the owners follow them in rowboats, guiding them when necessary. Care must be taken to prevent collisions and possible damage. The yachts are carefully made and are expensive

Was This the First Man?

Reconstructed from bones forty thousand years old, found in the Neander valley, this picture is scientifically correct

By Charles R. Knight

LET me take you back forty thousand years to a place in Germany called the Neander valley (Neanderthal). And there let me show you the fierce, half-brutish savage that roamed the wilderness—the creature that, as far as science now knows, was one of Nature's very earliest attempts at creating the species *Homo*.

As he slinks out of his cave or rock shelter to kill for his woman and his newborn babe, mark how short and squat he is. He is not the towering giant that the popular imagination conjures up when it thinks of primitive man. By actual measurement he stands but five feet two inches in height. Many a modern girl is taller. Yet he looks as strong as he is. His legs are stocky; his shoulders broad. His head is large—larger than one would expect of a man so short. It dwarfs him, in a sense; it makes him seem smaller than he really is. And his lowering face accentuates his squat ferocity.

The Neanderthal Man No Weakling

How low his forehead! What great bony ridges beetle his deep-set eyes! Never was there such a long, flat skull on any man that followed him. And his chin—where is it? A weakling, you argue, if the chin is any index to strength of character. But this man was no weakling. Look at his profile. That deep and heavy jaw and the gorillalike character that accompanies it—there determination is stamped, the determination to fight for life and all that life means.

How strangely the whole face is projected in front of the eyes, and with it the heavy nose and the coarse, protruding lips.

This man is no Apollo. But what he lacks in beauty he more than supplies in aggressiveness and resourcefulness. He may suggest an ape, but he is a man for all that, and a man who towers mentally far above the beasts that he hunts.

There is a curious stoop to his hairy shoulders. The powerful arms are covered with long, coarse hair. And his legs—how short they are below the knee! His feet, massive as they are, rest not flat and solid on the ground, but somewhat on the outer edges.

What thoughts teem behind that slanted brow? Science cannot answer. It can only measure his bones and reconstruct his physical appearance. Who knows but behind those piercing eyes there is a yearning toward higher things? As he stands before us in all his primeval shagginess, grasping his heavy wooden spear in the moonlight—and so I have shown him in my drawing on the opposite page—he thrills us. This is our ancestor; this is the creature from which we evolved; this thing is bone of our bone, flesh of our flesh. We are stirred by *his* passions, urged on by *his* nameless instincts. Forty thousand years separate us from him. But millions of years separate him from still lower animals. He stands close to us—this cunning, fighting, hunting, ferocious Neanderthal man.

What Is Time to Nature?

Time—what is time to Nature the great experimenter! A century to her is but as a single tick of the clock to us. She raises and lowers the temperature of the earth; she inundates whole continents; she shrugs her shoulders, and we call it a volcanic upheaval. Forthwith everything that swims, crawls, and flies must adapt itself to the new conditions. She throws dinosaurs on the scrapheap because they flounder helplessly under new conditions. She wants change, change, and change again. She experiments with this animal form and that, only to discard it for something that suits her new purpose.

And so she molded the primeval living matter, the protoplasm of which all organic things are made, to produce the wonderful mechanism that we call man. The Neanderthal savage was but one of perhaps many man-making experiments. Some of her attempts at creating a man are still to be found on the earth. There are the Veddas of Ceylon and the Bushmen of Australia. The Neanderthal man was, to a casual observer, no more primitive than are they.

Other Experiments in Man-Making

Nature was not too well pleased with the Neanderthal man. Almost simultaneously she developed the Cro-Magnons, whose remains are found sometimes associated with those of the Neanderthal man. These Cro-Magnons were beautiful to look upon.

A Cro-Magnon stood six feet and two inches. He was an artist in every sense of the word. His spirited colored drawings, sketched on the walls of French and Spanish caves, prove it. Probably he clothed himself in skin garments sewed together with bone awls; for such implements have been found in his burial-grounds. He had brain as well as brawn, and may have driven the Neanderthal man before him and annihilated him.

But why did Nature develop two such entirely different types of man in practically the same environment? Science digs into the earth, finds charred embers of fires long since dead, studies the scratchings on caves, and measures bones. But the answer? *That* Nature keeps to herself.

Nature's Great Experiment

It took Nature millions of years to evolve life on the earth, and millions more to create man. What was her first experiment in man-making?

We asked Mr. Charles R. Knight, of the American Museum of Natural History, New York city, to answer this question in an article for the Popular Science Monthly. Mr. Knight is a distinguished artist, whose restorations of prehistoric animals and men have won for him international reputation. The drawing that he has made to accompany his article is based on actual measurements of the bones of one of the oldest men known to science. It is not a fantastic conception, but an actual interpretation, the first of its kind, to the artist's knowledge, that has ever been prepared,—and embodies a study of the latest scientific data available on the subject.—Editor.

And Was This the Being from Whom We Sprang?

Practically the oldest bones of any human type are those found in the Neander valley in Germany. From these bones Mr. Charles R. Knight has reconstructed the Neanderthal man in this first scientifically accurate picture.

This early man lived in caves. He used flint spear-heads and knives—probably his spears were more often made of tough wood.

He is here sallying forth on a nocturnal hunting expedition. Every detail is scientifically correct, from the large head to the short legs and enormous feet

Adjustable Locomotive Seats

SHORT men or tall can use this locomotive seat. It was made especially for engineers. It can be raised or lowered six inches to accommodate a man from five to six feet in height.

The seat is supported on rack members that rest on brackets attached to a box carried on locomotives. Tools and other equipment are kept in the box. The engineer has merely to adjust the seat.

The vibration of the locomotive will not dislodge it.

Concrete Jails for Criminals

THE country jail has long been a standing joke. If the tales told about it are true, no desperado ever took it seriously.

There must be some truth in these yarns, for the town of Mansfield, Missouri, has built itself a calaboose of reenforced concrete, strong enough to hold the boldest jail-breaker. It has accommodations for a number of law-breakers.

"Breaking" this jail would not be easy. If a man had a full set of tools, including a hacksaw and several dozen blades for it, he might be able to get out in three days if he worked steadily.

Sheep Haul the Produce of the Farm

IN New South Wales a schoolboy grows enough vegetables to feed a family of six. He does it with the aid of his father's sheep.

He had taught them to pull a light handplow and to haul his homemade "push" car. Two wethers could easily draw the plow over the boy's garden. Three sheep haul a load of two bags, or six bushels, of wheat.

In addition to carrying produce from the garden in this way, the sheep also haul all the wood required for fuel. It is surprising how well the sheep have been broken in. They allow themselves to be yoked without any sign of fear or dislike, in fact behaved just like any draft animal.

Foreign Crops in the United States

MANY of the grasses that now form important crops in the United States were introduced by accident. This is true of "Kentucky" blue grass, white clover, and others.

But the Department of Agriculture is always scouring foreign countries for new crops. Alfalfa was imported in 1854 from Central Asia; Japanese rices in 1899.

Durum wheat, introduced from Russia in 1899, now produces a crop worth $50,000,000 annually. Egyptian cotton grew to be worth $20,000,000 in 1919.

It must not be imagined that it is necessary merely to bring in new seeds. Scientists carefully consider the adaptability and acclimatization of foreign plants.

Plotting Accidents on a Map

A TRAFFIC expert of Washington, D. C., has gone about the task of eliminating automobile accidents in a thoroughly scientific manner. First find where most of the accidents happen, and then apply the remedy.

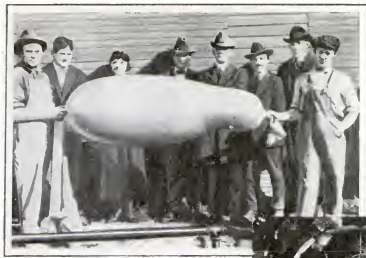
That is the way William Eno reasoned it out. To do this, he employs a map of the city, and records on it daily the accidents, employing small colored pins. The pins, of course, are thickest at the danger points.

The death rate due to automobile accidents in Washington is twice as large as that of New York city.

Over the Hill or Around It

LOS ANGELES must be a very convenient city—especially for automobilists. Where a road leads over a steep hill, a second road is provided that goes around the hill.

The road that leads over the hump is the shortest way. The road that leads around the hill is the easiest way. If a man comes along in a big powerful car, he generally chooses the steep road. When a driver approaches the hill with a limping "flivver," he decides—if he is wise—on the long route. Very often "the longest way round is the shortest way home."



When Rubber Is Uncured

RUBBER is a peculiar substance. It must be treated just right before it will stand up under service. This is the way an inner tube would look, when inflated, it if did not receive the curing or vulcanizing process that makes it tough and durable.

Curing must be carried on carefully to give a perfectly uniform rubber structure. If an uncured tube is inflated, certain parts of it will swell to an enormous size, while other parts will remain virtually unaffected by the air pressure.

A cured inner tube, when inflated, will have a uniform diameter.

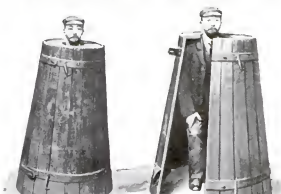
Since the advent of the automobile, much research work has been going on in the production of this important product, which has added much comfort to riding.

Drunkards in the Middle Ages

NEVER was there a time when a drunken man received envious or admiring glances. In fact, many years ago he was severely punished by his horrified brethren. He was forced to wear a "drunkard's cloak," which was in reality a large wooden pail with a hole in the bottom and an opening down the side. The man's head went through the hole.

The pail was turned upside down and the drunkard was locked in, in the manner shown below.

If he walked with difficulty before, what must he have done after? As he had to wear this cloak until he promised to be a better man, in other words, to sign the pledge, it is not difficult to imagine that he was soon in a penitent frame of mind.



Imitating the Spider's Web to Catch Flies

A SPIDER'S web has great attraction for the average fly; he needs no enticing personal invitation from the spider such as we learned in the second school reader. This being the case, an Englishman decided to copy the spider; he built a fly-trap that looks like a large-sized web.

He used his son's discarded hoople as a base, and strung threads across it in the manner shown above. Then he smeared a sticky substance flavored with poison on the threads, and fastened a piece of meat at the center as bait. Before long the threads were covered with dead flies.

Weeds and the Law

WEEDS are flagrant lawbreakers. In spite of the fact that twenty-five years ago most of the Northwestern states of the United States made it illegal to allow Russian thistle to grow, this weed has spread from the Atlantic to the Pacific. Weeds in general are far more serious enemies to food plants than is usually recognized. Even students of this branch of agriculture know very little about the actual effect of weeds on plant diseases or of weed roots on crop growth.

An interesting phase of this subject relates to the scarcity of water in some sections of the country. All plants require much water in the process of growth. It is said that a sunflower consumes as much water daily as does a hill of corn. There is no doubt, therefore, that weeds can do growing crops considerable damage in using up moisture.

Dress-Forms Made at Home

THE United States Department of Agriculture is teaching women to make their own dress-forms.

The only materials needed are a gauze shirt, some gummed paper, cardboard, scissors, tape-measure, pins, a sponge, water, and a pencil.

The foundation of the form is a gauze shirt two sizes smaller than the model usually wears, in order to have the tightest possible fit. The model puts this on over her corsets and a well fitting petticoat. The edges of the shirt are reenforced with strips of gummed paper. These strips are then applied with care all over the shirt, always running vertically, until the foundation is completely covered.

When dry, the form is cut down the center of the back and pasted together.

Blow the Plaster on the Wall

USE the stucco machine shown below and you cut down the cost of the inside finishing of a building.

Plaster and stucco are contained in a cast-iron tank, which, together with the gasoline engine that drives the air-compressor, is mounted on wheels. The semi-liquid mass is fed through rubber tubes. At the end of each tube the liquid stucco enters a nozzle connected with the air-compressor by another tube.

Compressed air at a pressure of 22 pounds sprays the stucco mass to a maximum distance of 250 feet and a height of 150 feet. The stucco adheres firmly to wall or ceiling.

To Study the Weather

BOX-KITES used by weather men for measuring atmospheric conditions occasionally develop a tendency to fly sideways or to perform other antics in the air that interfere with the accuracy of observation.

If there is one weak stick in the framework of the kite, the strain of the wind on the sails is sufficient to produce distortions, and this leads to bad flying. Such defects are not, however, generally apparent until the kite is in the air.

It has been found that a kite fastened by a short line to the top of a flagpole will fly steadily in ordinary winds, and can be studied at leisure.

Good Positions, Good Pictures

WHEN the *Omaha* was launched at Tacoma, Washington, the moving-picture camera-men scratched their heads trying to think of a suitable place to "shoot" the picture from. They wanted to be high and in the center.

Why not use the crane and a material-handling box? Within fifteen minutes' time they were swung out over the crowd. When the *Omaha* started down the launching-ways, two cameras were very busy.

Cleaning Tall Street Lamps

IN the larger cities, a truck with an adjustable platform is used to take care of the street lamps. The man in our picture does the work without a truck. He carries a single-pole ladder that has a hook at one end. He simply places the hook over the top of the lamp-post and climbs up.

The pole has heavy steel rungs to support him.

When he gets to the top, he twists his legs around the ladder to hold himself, and renews or cleans the lamp.

When he has finished his work, he climbs down, and carries his ladder to his next job.

One Man Operates This Conveyor

ONCE thirty men used to do the work this conveyor is now doing. The engineer who designed this conveyor used to stand and watch a score of men toiling in the sun to lift boxes and barrels up the embankment.

This was down on the old Mississippi, where the sun is really hot. The engineer convinced the officers of his company that he could get the material up the embankment at a fraction of the price they were paying.

They gave him seven thousand dollars, and he set about building this electric conveyor. It has a moving belt that pulls the boxes and barrels up the slope in a hurry.

About Machine Dish-Washing

FEW human dish-washers would refuse to give up their jobs to machines. The electric dish-washer is an expensive piece of mechanism in home kitchens; but in restaurants and school kitchens it pays to employ machinery for cleaning dishes.

Hand-washed dishes contain forty times as many bacteria as machine-washed ones.

A Ton of Steel at Every Shot

THIS is the way the United States government would build "Big Berthas." Let us compare this big fellow with the guns carried on the old *Constitution*, which did its fighting in the days of our great-grandfathers. A broadside from the *Constitution's* twenty-two 32-pounders had a total weight of 704 pounds. The shell from this big gun weighs 2700 pounds and measures 16 inches in diameter.

The new gun is of the disappearing type, and is to be used in coast-defense work. The slanting cape of steel is to ward off bombs that might be dropped by enemy airplanes.

With This Instrument You Can Hear Yourself Talk

NONE of us knows how he talks. We are so used to our own voices that we overlook our vocal defects.

Now, here is a device that enables you to listen critically to your own voice. It shuts out all outside sounds, and, at the same time, it magnifies the voice about ten times. If every spoken word were magnified thus, it would be easy to detect defects in speech, and once they are found they can, by practice, be corrected.

Hear your own voice, discover the defects in enunciation, and you will talk better.

Listen to your softest tones magnified ten times in your ear, and you will sing better.

Hammocks Instead of Taxis

TRAVELING through the Orient—that sounds much simpler than it really is. In many places the roads are almost impassable, and none but the coolies attempt to walk them. How, then, do tourists and the people of the upper class manage to travel on routes where the roads are so poor? They are carried in various ways by coolies.

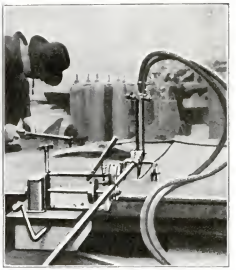
In the picture below you see a crew of coolies prepared to take their wealthy employers on a trip across a mountain pass. They carry on their shoulders poles from which hang hammocks of woven grass. Above these hammocks are grass awnings that will protect the occupants from the glare of the sun.

The coolies travel at the rate of about three miles an hour, and receive from twenty to thirty cents a day, which seems little enough for such hard work.

Cutting Armor-Plate with a Flame

FOUR thousand tons of armor-plate shell-torn as the result of shooting tests, was to be sold as scrap iron. Therefore it had to be cut up. This was a difficult job even for the oxyacetylene flame. The plate was badly warped by the impact of the shells, and the holes made were ragged and mushroomed.

Specialists in work of this kind made special machines to cut up the plate. Each machine carries the torch automatically across the plate along the line to be cut. An ordinary spring phonograph motor drives the carriage. The machines paid for themselves on this one contract.



$1,000,000 to Save $25,000,000

IT sounds like good finance, doesn't it, one million dollars to save twenty-five millions? That was the estimated amount needed to prevent forest fires in 1921.

Everybody who reads knows what the shortage of paper has meant in the past three years—business failures, higher prices for books and magazines, a shortage in the market even of standard authors in cases where publishers are holding off new editions in the hope of a drop in prices. Yet the combined effort of pulp manufacturers, lumber associations, chambers of commerce, and the American Forestry Association failed to make Congress appropriate more than the usual $125,000.

Eye Magnet Becomes a First-Aid Tool

MAGNETS to remove particles of steel from the eye are not new. Still, the eye magnet invented by Dr. Charles W. Burrows, formerly Chief of the Magnetic Division of the United States Bureau of Standards, is worth describing and illustrating, because it meets the need for an efficient instrument for first-aid needs.

It consists of a powerful electromagnet, light enough to be held in one hand and small enough so that the knurled grip permits the operator to extract a steel particle with ease. The weight of the magnet falls upon the operator's arm. At the end of the casing, and close to the magnet, is a small lamp-bulb that throws a soft light directly on the injured eye.

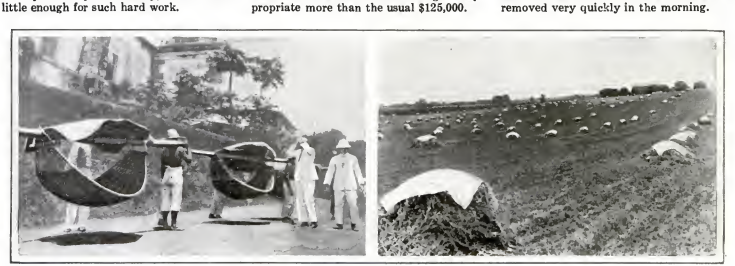
Blankets Protect Alfalfa

ALMOST every farmer ranks well as an inventor, for he must always be inventing substitutes and applying his inventive faculties to all kinds of problems met on the farm.

Dew and rain used to destroy alfalfa before it had a chance to cure in the sunlight.

Now the alfalfa is put to bed every night. A heavy blanket of canvas is placed over the piles on the field. This protects them from rain, and in the morning the farmer removes the blankets, again exposing the alfalfa to the beneficial sunlight.

This is a simple way of saving money by preserving the crops. It is no great job to protect the alfalfa from rain and damp. A few men can cover a number of acres in a few minutes' time. The blankets can be removed very quickly in the morning.



One Banjo Makes an Orchestra

WHEN you look at the instrument in the picture above, you think at first that it is a banjo; but when you notice that the top of the instrument almost touches the ceiling, you realize how large it is. It is five feet tall. What is it? An orchestra.

Behind the drum and inside of the neck are several musical instruments. When these are wound up and set off, they play musical records with all the gusto of a man-made orchestra. The instrument even includes chimes.

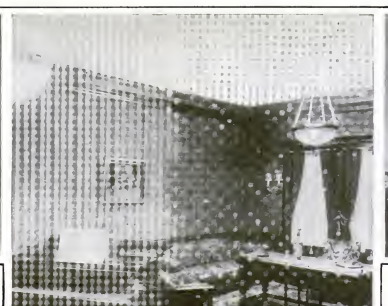
The four strings on the outside of the instrument are made of steel covered with copper thread. These may be tuned and played, if desired.

Vegetables Turned Into Flowers

CARVING vegetables into shapes resembling flowers is not a novelty, but the chef in the picture is an artist in vegetable-carving.

Glance at the spray of rosebuds in the vase. From the tightly closed bud to the one that is unfolding its petals, they are perfect. But should you attempt to catch their odor, disappointment would be your portion, because those beautiful rosebuds are nothing more than Irish potatoes in masquerade.

The creator of so much beauty is a returned Italian soldier. He is to be envied when one reflects that the commonest vegetable, seen through his eyes, becomes a beautiful flower.

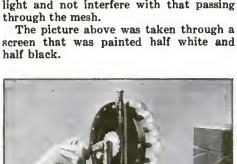


Black-and-White Screens Assure Invisibility

SHOULD you want to prevent outsiders from looking in, and yet wish to see what goes on outside, paint window-screens white outside and black inside.

Black absorbs light, whereas white reflects it. Thus, if you paint the outside of your screens white, the light will be reflected and will appear to blur. Whereas black paint on the inside will absorb all the light and not interfere with that passing through the mesh.

The picture above was taken through a screen that was painted half white and half black.



"Heatless" Light for the Movies

THE arc light that furnishes illumination for the artificial sunlight of the moving-picture also furnishes an enormous amount of heat. A metal shutter protects the inflammable film when the pictures are not in motion.

Now, however, the shutter can be dispensed with, for a "cold" light has been invented by M. Dussaud that consists of a wheel or disk upon the edge of which are sixteen incandescent lamps. As the wheel revolves, each lamp is subjected to the closed circuit and is lighted brilliantly. The light is continuous, since one lamp is always aglow. The illumination of a single lamp is but momentary, and the high amperage cannot burn out the filament.

Nature's Own Field-Artillery

EVEN Nature is on the war-path. A mushroom has been found that actually explodes.

Naturalists call this mushroom the lycoperdon; country boys call it a "puffball." The interior of this mushroom contains a spongy, white mass.

When the lycoperdon is young, it is very good to eat, like all other well-behaved mushrooms. But when it grows old, a white powder forms from the spongy mass that expands and breaks the outer covering with a slight noise. The heat of the sun causes this expansion to take place. Our picture shows a mushroom in the act of exploding.

Going to Sea in a Kettle

INDIA, which covers about one third the area of the United States, and which has more than three times as many inhabitants, has retained some of the most primitive customs. In the rainy season the tributaries of the Ganges and other streams change greatly in level.

Some rivers are easily crossed without bridges, by fording. But for travelers who do not wish to get their feet wet, the natives bring forth any handy utensil that will serve as a boat.

The large brass kettle shown in the picture serves very well as long as the guides keep it pointed in the right direction, and do not keep the traveler too long in such a cramped position.

Seed-Sower Operated Like a Hand Organ

SEEDS must be planted with care. That is one of the fundamentals of successful farming.

Realizing this, a farmer developed a seeding-machine that could be used by an inexperienced person.

This sower operates like a hand-organ. Turn the crank, and a small disk revolves rapidly.

Meanwhile the other hand controls a shutter that allows the seeds to fall upon the moving disk when it is open. The seeds, falling upon the moving disk, are thrown off by centrifugal force and are scattered in the proper manner.

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Painting Pictures from an Automobile

WHEN an artist tries to paint a street scene, a crowd of people invariably gathers around.

How can he avoid this annoyance?

Harry Lachman, an American artist, remains in his automobile when he wishes to paint. He opens a trapdoor in the top of his sedan. By placing his canvas and paints on top of the car, and by standing on the rear seat, he avoids the crowd. He places a screen around the top of the car and pulls down the shades inside so that he is invisible.

How This Little Pig Went to Market

THIS little pig went to market, but he had the distinction of going in an entirely new way. First his feet were tied together; then a stick was placed across his back and another beneath his body. Strong banana leaves were wound around him and them.

Next, a long handle was made by braiding more leaves; this handle was attached to the ends of the upper stick. The young boy whose job it was to take the pig to market swung the handle over his shoulder and let the pig hang. It may not be as comfortable for the pig, but it is easier for the master than driving him.

One Guard Operates a Train

"NEXT stop, Times Square," bawls the subway guard; but you don't see him. His voice comes to you by telephone from another car.

This is a feature of the one-guard-to-a-train system that is being operated in New York city.

The guard controls all doors of a six-car train by a handle in one of the cars. He is shown preparing for a station. With a telephone mouthpiece and the handle, he is ready to start operations when the train stops.

A Line-Up of Telephone Nickels

IF all the nickels that are dropped into the telephone pay-station slots during a year were placed edge to edge, they would form a line from New York to San Francisco and then extend far out into the Pacific ocean. There are four hundred million of them!

Rubber Bathing-Suits Now

AT first glance this bathing-girl looks like any other bathing-girl; but when you look closely at her bathing-suit and cape, you notice that they are made of rubber (price, seventy-five dollars!).

What are the merits of a rubber bathing-suit? In the first place, it is different, and that is always an attraction. Then, it will not fade if worn in the sun. And should the wearer actually go in the water, she will find afterward that her rubber suit dries quickly.

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Air-Travel Rates

THE rapidity with which Europeans are taking to airplane travel may be gaged by the fact that representatives of the principal airplane companies recently met at Brussels to determine rates for travel through the air.

The fare between Paris and Brussels was fixed at 150 francs (ten dollars) and that between Brussels and London at 175 francs (twelve dollars).

Fish in Dry-Dock

A SCHOOL of fish were swimming near a dry-dock at Balboa; it so happened that a ship was expected at about that time and the gates were opened. What then? The school swam in. Later, when the water was pumped out, they were stranded on the bottom. The workmen carried home as many as they could eat, and government men disposed of 650 pounds.

New York's Wonderful Fire Doctor

How Dr. Harry M. Archer risks his life in treating wounded fire-fighters

By Raymonde G. Doyle

One of the most necessary pieces of apparatus is an oxygen-tank. A compartment in the car carries it

IF any one were to set down the biography of Dr. Harry M. Archer, of New York, one of the first facts he would record would be that the doctor is chief surgeon of the Fire Department there. He might go further and say that Dr. Archer is regarded as a hero in the department, and that he holds a medal inscribed, "For Valor." He has earned it, together with high public regard, for the reason that he has worked for more than a quarter of a century to build up the emergency medical service that he directs.

The automobile in which Dr. Archer races to big fires probably stands alone in its class. It isn't really an ambulance. It looks more like a pleasure car as it goes by. As a matter of fact, it is virtually a complete hospital on wheels, provided, among other things, with a power plant that can send it sixty miles an hour. He drives it himself, and the car is always ready for instant service at a firehouse near his home.

The automobile is divided into compartments that are dust- and moisture-proof. They are fully stocked at all times with splints, surgical needles, and the sutures needed in the treatment of bad cuts. Cotton gauze, antiseptics, forceps, lancets—they are all there.

There Is Even an Oxygen Machine

And fastened securely so that a jolt cannot loosen it, is an oxygen machine.

When oxygen was gaining prominence as a restorative agent in the treatment of partial suffocation, Dr. Archer found it successful. But he saw himself in a situation where the purest, freshest oxygen would be needed, and he realized that it might not be possible to get a tankful instantly.

Forthwith the doctor provided himself with an oxygen generator and the chemical necessary to the manufacture of the gas. He had a special compartment fitted into the automobile, and in it stored his generator and the chemical—sulphite of soda. Water poured on the sulphite of soda generates the oxygen.

The war produced a comparatively new treatment for burns—the paraffin treatment. The men of the New York Fire Department were among the first in this country to benefit by it.

The Archer automobile is equipped with the apparatus used in spraying the melted paraffin. There is a specially constructed atomizer in which the hot liquid is vaporized, a ladle in which it is heated to 180°, and a supply of "canned heat" to complete the apparatus. Occasionally the canned heat has given out, and then fire-boxes of the department engines served instead. Some day, Dr. Archer hopes, the engine of the automobile will be provided with an arrangement for melting the paraffin.

Dr. Harry M. Archer, whose work for the department is merely a side job. He carries the rank of battalion chief

But the list of articles in this trick automobile is not yet exhausted. The sight of a badly injured fireman or an unconscious smoke or gas victim is all that is necessary to send the department's chief surgeon on the run to the car. In an instant he could produce army cots and blankets. And should the necessity for artificial respiration arise, out would come a pulmotor.

Behind Dr. Archer's thirty-five years of service to the men of the department and their families, there stands a list of some thirty thousand emergency cases that he has attended. In that time he has not missed a single big fire.

The paraffin treatment for burns, one of the things discovered by war surgeons, was early adopted by New York's fire doctor

The Fire Doctor a Hero

But it is on the records that Dr. Archer has risked his life often and cheerfully to make fire-fighting easier for his men. And it is a matter of record, too, that one of these occasions arose when he calmly climbed down from his racing ambulance during the big fire in the Equitable Building, took a hypodermic syringe and a phial of drug from a compartment, and started for the entrance of the structure.

And he went inside, dodging burning embers and falling bits of stone—went to a point where an official of the Equitable Company had been trapped behind a heavy iron grating while trying to save valuable papers. Firemen were sawing the bars of the grating to release the man behind them. He was suffering, and he couldn't be taken to the automobile for treatment. Dr. Archer pushed his hand through the bars and administered morphine to him, and then went back to the automobile and prepared a cot for the time when he should be released and carried to safety.

The medal was presented for that deed.

Dr. Archer's work for the firemen is a side job, so to speak. As a regular thing he directs the work of the physicians and nurses of a life insurance company. In the Fire Department he is a volunteer with the rank of battalion chief and he pays his own expenses.

Take Your Camera and Go Fishing

You will discover a new world of fantastic creatures

"HUNTING with a camera" is a fascinating sport, well known and widely practised by lovers of nature, but it has remained for Professor W. H. Longley, of Goucher College, to inaugurate a new method of catching nature unawares—"fishing with a camera." The aim of this new form of investigation was to bring to light new material on the familiar biological bone of contention—what is the purpose of the brilliant colors and striking patterns displayed by certain animals and fishes? It has been believed that this type of coloration is due wholly to sexual selection. Not until recently, when the war brought to our notice the obliterative effect of contrasting and sometimes brilliant colors daubed on guns, ships, and motor-trucks, was much credence given to the theory that these striking patterns on animals and fishes may really conceal them.

Professor Longley's underwater studies tend to support this hypothesis. His investigations were carried on on the rich reefs in the warm waters of the tropics. Equipped with a launch, a diving-hood, and a water-tight camera, it was possible to spend hours in these warm waters with no danger and little discomfort.

The camera was protected by a water-tight holder provided with a round window in the end opposite the lens, the necessary operations attending a snapshot or a time exposure being accomplished by means of various contrivances attached to the container.

Adjusting the hood and stepping over the edge of the boat into the water, the "camera-fisher" finds himself in a new world—a still, shadowy world of mystery, where swift forms shoot by and others loll idly about, none paying the least attention to the strange new thing in their midst. The dense foliage of the water world rolls gently with the swell overhead, yet no sound is heard from above or below.

An interesting phase of the coloration of fishes is the fact that in many species it is changeable, the scheme adapting itself, as far as possible, to its surroundings. By means of a sea-urchin or other bait, fishes were drawn from one group of surroundings to another, and the color changes to accord with the background were thus produced at the will of the observer. All the evidence we now have points to the fact that coloration in fishes, somber or brilliant, has for its aim the concealing of the wearer from enemies or possible prey.

It would appear that coloration in fishes is for concealment from enemies or prey

With launch, diving-hood, and water-tight camera, the professor spent hours in tropical waters, studying marine life

The patterns, too, are often changeable, in many species from longitudinal stripes to bands around the body. Where this is the case, the lengthwise stripes appear when the fish is in motion, and the transverse bands when it is at rest.

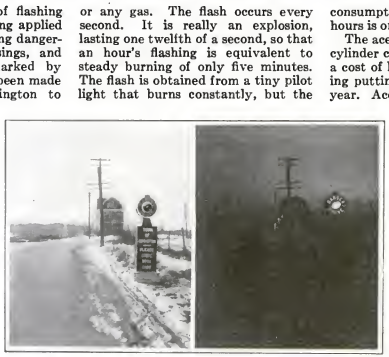
The Lighthouse Comes Inland to Direct Traffic

THE unattended type of flashing marine light is now being applied to highway purposes, marking dangerous curves, railroad crossings, and other places heretofore marked by signs. An installation has been made on the road from Washington to Mount Vernon, and the lights are also to be installed in the White House grounds. They operate with the same mechanism as the marine light, and their application to highway purposes by a company that supplies marine lights to nearly every government in the world is an interesting extension of the sales possibilities of equipment for which government demand alone is limited.

Purified acetylene dissolved in acetone under pressure furnishes the light. This has been found best because more brilliant than electricity or any gas. The flash occurs every second. It is really an explosion, lasting one twelfth of a second, so that an hour's flashing is equivalent to steady burning of only five minutes. The flash is obtained from a tiny pilot light that burns constantly, but the consumption of gas in twenty-four hours is only 0.6 of a cubic foot.

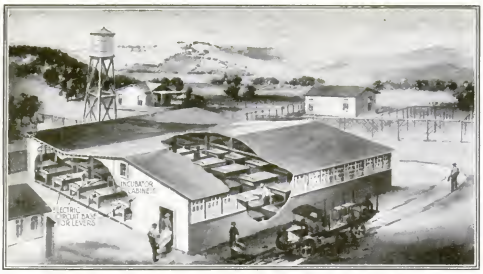
The acetylene gas is stored in a steel cylinder containing a year's supply, at a cost of less than five dollars, including putting in a fresh cylinder once a year. Acetone has capacity to absorb many times its own volume of acetylene, so that a large volume of gas can be stored in a small cylinder. In an ordinary cylinder, however, it would be explosive, so a receptacle has been worked out by Dr. Dalen, who perfected automatic marine lights.

One marked advantage of the highway lighthouse is standardization in color, wording, location, and symbols to indicate the direction of curves, distance of railroad crossings, and so forth. Railroad usage is adopted, using red for danger, yellow for caution, and green for clear.



If a standardized system of colors and signs is adopted, a California motorist in Ohio will instantly recognize potential trouble

The flash occurs every second. It is a flare, lasting one-twelfth of a second, an hour's flashing being equivalent to five minutes' steady burning



California has the largest electric chicken hatchery in the world; it hatches 100,000 eggs at a time, and has a monthly output of 120,000 chicks

Chicken Farming by Electricity

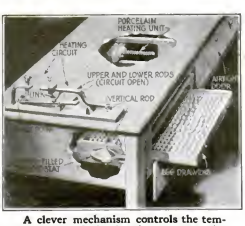
THE largest electric chicken hatchery in the world is located near Artesia, California. It has a hatching capacity of about 100,000 eggs and a monthly output of approximately 120,000 chicks. Chicken hatchery experts claim that this electric chicken farm has gone old mother hen one better in that the hatching is done automatically and positively, whereas the old hen is sometimes negative in that she will desert her nest on occasion.

While many other methods, among them the kerosene lamp, gas heater, solar heater, and steam, have been employed to hatch eggs, the electric method has one important advantage over them all—it is automatic in operation and provides a uniform heat of constant temperature—a most necessary requisite for successful hatching. The electro-incubation method has several other advantages, including the elimination of the fire danger. Then, there are no lamps to clean, fill, and adjust, and no gas-burner to go out and asphyxiate the chicks with the escaping gas. Again, because of the automatic control of the temperature, there is less chance of loss of chicks due to chilling or overheating the atmosphere.

The automatic heat regulation is made possible by the use of a thermostat of the tandem wafer type. The wafer is made up of two brass disks. These are soldered together, and the air space between is filled with ether. The disks are placed horizontally, with a vertical control rod attached to the top wafer. This rod operates a horizontal control lever, the other end of which is weighted to give a steady and positive action. This lever actuates a rocker arm connected to the midpoint of the lever by a coil-spring. The rocker arm makes the contact to open or close the circuit. The entire control operates through the expansion or contraction of the ether between the disks. This ether is so volatile that a slight variation in temperature will cause the wafer to expand or contract, thus closing or opening the circuit.

The same control has been adapted to the electric brooder, to which in addition has been added an alarm-bell system to give immediate warning of any sudden temperature fluctuation. In each case the electric heating unit consists of a cylindrical porcelain core with grooves into which are wound the resistance wire, so that the coil is self-insulating with no danger of the coils coming into contact with any metal parts that might cause a short circuit and result in a fire.

Thus the hen is left entirely free for her task of egg production. Even in this work she is further urged by electricity used in the form of lights inside the coops to get the hens on the job earlier in the day.



A clever mechanism controls the temperature of the hatchery automatically; the electric plan eliminates danger of overheating or chilling

Sending Freight in Steel Boxes

IF the freight-car here pictured comes into wide use, valuable freight may be sent with every assurance that it will reach its destination in perfect condition. Incidentally this "container car," as it is called, will save the railroads money. It will eliminate rehandling, billings, and rechecking. Theft will be prevented and valuable shipments will receive every protection from fire and wrecks. The car carries nine steel containers, each containing an individual shipment. The containers may be lifted off at various stations. Each container will accommodate a load of five thousand pounds.

A crane is used to lift the big steel boxes off the platform of the car. The New York Central Railroad recently attached one of the new container cars to a New York-Chicago train.

Photographs © Kadel & Herbert

In this idea for railroad freight-handling, each car carries nine steel containers of uniform size, which avoid all damage to freight

How the Unscrupulous Beat Slot-Machines

TELEPHONE coin-boxes take three different-sized coins—a nickel, a dime, and a quarter. When a coin is dropped into the opening at the top of the box, it is automatically weighed and measured before a connection with Central is established; a Chinese yen, if it were the proper weight and thickness, would bring a "Number, please?" from Central.

Since the war New York has been flooded with foreign coins, many of which are the same size and weight as our "jit." Hence, the telephone company receives a daily collection of souvenirs. But the greatest source of annoyance are the "nickel testers." These are smooth brass checks, with the weight and size of a nickel.

Driving Piles on a New Principle

NOTHING is perfect—not even pile-drivers. Realizing this, an inventor produced a better pile-driver—one that pulls the piles into the ground. The blows do not strike the pile itself. Therein lies the value of the new device. Concrete piles may be sunk without danger of breaking or cracking, and wooden piles without danger of splitting.

The new pile-driver delivers tremendous blows on driving bars that bear on the projecting edges of a pointed cast-iron shoe fastened on the lower end of the pile. The pile itself is subject only to tension, since the shoe pulls it into the ground and does not drive it. When very hard ground is met, the old type of pile-driver must deliver thousands of blows with a hammer that weighs from two to three tons. Under this treatment, even a heavy wooden pile often suffers severe injury. The new pile-driver can strike thousands of blows without injuring the pile in the least.

Imagine a large pile sinking into the earth at the rate of twenty-six feet in four minutes. That is the speed maintained by this pile-driver. This rate of movement was made without a water jet playing on the end of the pile. It was driven down "dry." When water is used, resistance is decreased somewhat and greater speed is possible.

The pile is placed between large steel girders. These also carry a slideway for the big cast-steel hammer that weighs several tons. The hammer is lifted by a powerful steam-engine.

Set between steel girders, the pile is practically pulled into the ground

Seining to collect young fishes from a bayou as its waters recede into the great Mississippi river

Dry-Land Fishermen

WHEN the Mississippi river rises with the season's freshets, it covers wide areas of flatland and the fish swarm over this region with the flood water. Following their natural trend, they seek the deeper pools in the quiet backwaters, many of which seem to possess the proper qualification for breeding-grounds. Here the eggs are laid, but before the young fish come to maturity the waters may have begun to recede. The older fish are wise enough to get away into the river channel before they are "marooned" in these shallow land-pools, which were the deeper spots dotting the flooded flatlands.

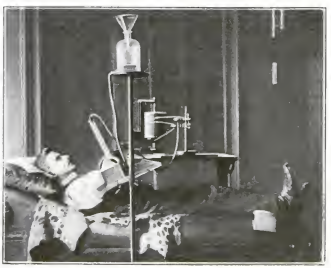
The United States Bureau of Fisheries has undertaken the task of rescuing the stranded young and thus saving many hundreds of thousands of fish for food.

After the flood waters had receded, leaving the stagnant pools full of young fishes, seining parties were sent out to collect them. Thousands of young trout, bass, and other fish are corralled in the nets and transported to the rivers.

Do You Know How Hard You Can Work?

AS a man reaches his limit of physical performance, when he virtually becomes exhausted, his blood-vessels are no longer widened, but on the contrary contracted. His heart finds it hard to widen the vessels sufficiently to allow the blood to pass. With this fact in view, Dr. E. Weber, of the University of Berlin, has devised a method of measuring the amount of work a man can do.

All physical work is accompanied by combustion in the muscles. You burn up oxygen like a fire. The harder you work the more oxygen you need. Hence your blood must carry more oxygen. The widening of your blood-vessels occurs spontaneously, so as to supply more oxygen as you need it. When the limit is reached, the vessels begin to contract so that the heart must work harder to widen the veins. Exhaustion follows.



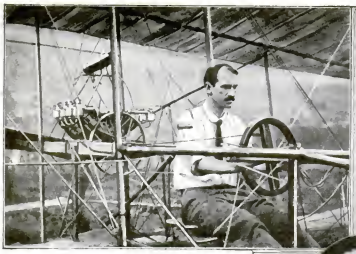
You burn oxygen like a fire. The harder you work the more you consume. Your blood-vessels dilate so that the blood can take up more of it. When the limit is reached, the blood-vessels contract, so that the heart must work harder to keep them dilated. This is the danger-point. It is the purpose of this apparatus to determine when the danger-point is reached

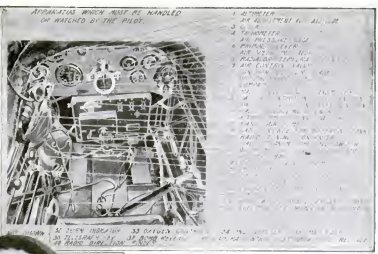
This is the danger-point. It is determined by introducing the arm into an apparatus consisting mainly of a tightly fitting cylinder, which is filled with water and which records on a rotating drum the variable volume of the arm (depending on the variable amount of blood contained therein). Breathing is recorded at the same time, also one foot performs a motion that can readily be checked.

The process ascertains the admissible and the most convenient number of working hours for any given operation.

After short intervals, during which some other group of muscles is operated, the output can even be increased beyond the danger-point.

How the Airplane Has Developed in Ten Years





THE pilots who flew the first airplanes, more than a decade ago, scarcely realized how brave they were. A modern flier, as he inspects machines of theirs that have been preserved, marvels at the flimsiness of construction and the utter lack of the instruments on which he depends for safety.

The Wright Brothers and Glenn H. Curtiss, whose picture appears on the left in one of his first machines, sat on the lower wing and watched the earth swim past between their legs. There was no streamlined body, no protection against the fierce blast of air set up by the moving machine—nothing.

Look now at the picture that appears at the right of Glenn H. Curtiss, a picture of a modern airplane's cockpit. No less than forty instruments and control devices stud the inner walls. At first glance it would seem as if a man must be many-legged and many-armed to manipulate all these devices. Some of them, to be sure, could be spared, such as the radio communication apparatus, the bomb releases, the machine-gun control, and the camera-operating mechanism; for all these are but military adjuncts, with most of which the civilian flier has nothing to do. But the rest—for the most part instruments that were not in existence when the pioneers flew—the rest are nowadays deemed indispensable.

If we needed any evidence of the wonderful progress that has been made in flying, surely we will find it in the half hundred gages, meters, and controllers of various types that the exigencies of aerial navigation have called into being

Shooting Ducks from an Airplane

DUCKS have been shot from airplanes. They have also been slaughtered by the simple process of running the plane through a flock, a proceeding that is effective but somewhat rough on the propeller if the blade gets a fair whack at a fat duck with the tip of a blade. Pictures showing masses of ducks shot by aviators always arouse questioning. With a plane gliding along at from seventy to one hundred miles an hour and a gunner pulling the trigger of a shotgun, the birds would be strung out over the ground below for five miles. If the machine landed every time a bird or two went down, that would entail finding a soft spot to land upon and finding a new flock on the reascent.

It is no trick for most planes to outfly the poor duck, in spite of the wild yarns as to duck speed by those who estimate their bag by the number of birds they missed.

Aviators tell of shooting birds occasionally in the neighborhood of some of the Texas fields, where they could follow the poor fowl down and retrieve him, but none of them ever made claim to any record-breaking bags. The *modus operandi* was to pick out a flock on the wing and then to overtake them from the rear and shoot them as the plane slowly passed. This would require no great skill, as the bird would appear to be moving not more than from ten to thirty miles an hour to the rear, or else standing still if the pilot throttled the engine down.

Hunting ducks by airplane, however, is not looked on favorably by the government. About two years ago the War Department issued an order forbidding army aviators to hunt from airplanes or to maneuver unnecessarily over the feeding- or resting-grounds of waterfowl. And now that aviators have attempted plowing through flocks of ducks, thereby killing hundreds with the propellers, it is likely that the War Department order will be extended by law to include all aviators. Surely this method of hunting is not sportsmanlike. One air-hunter, who proudly had his picture taken showing the day's kill, was charged with violation of the migratory-bird act.

© Keystone View Company

Shooting ducks from an airplane, or killing them by running the plane through a flock, is likely to be stopped by the government

Fertilizing the Air with Carbonic-Acid Gas

By Alfred Gradenwitz

IT has long been known that green plants derive the carbon required for building up their structures from the carbonic-acid gas mixed with the surrounding air.

It occurred to Dr. F. Riedel, of Essen, that vegetation might be stimulated in a high degree by artificially augmenting the carbonic-acid concentration of the surrounding air. He therefore set to work seeking some economical carbonic-acid supply, which he eventually found in the combustion gases plentifully escaping from the chimney-stacks of all factories, but most abundantly from those of blast-furnaces. Inasmuch as these gases contain some noxious components, such as sulphur, they, of course, had to be cleansed beforehand.

Tests on a large scale were recently made. The combustion gases were supplied to one hothouse by means of a double line of perforated pipe that ran the whole length of the house. Two other hothouses, of exactly the same construction, but lacking the supply of carbonic-acid gas, were used in the experiment for the sake of comparison.

That there could be no question of any noxious effect was noted a few days after starting the experiment. On the contrary, there was in the gas-treated hothouse a notably more thriving vegetation than in the remaining hothouses, where similar plants were grown without any carbonic-acid supply. The leaves of castor-oil plants in the carbonic-acid hothouse grew to twice the width of those growing in the ordinary hothouses. Tomatoes planted in the carbonic-acid hothouses weighed two and three quarter times as much as those grown in the other houses. With cucumbers there was noted, apart from a far more plentiful crop, a deeper green color; in all cases, an improvement of the flavor.

Other tests were made in the open air with an arrangement comprising rectangular sections bordered with perforated cement pipes, which supplied carbonic acid, the wind driving the gas in a varying direction toward the plants. On the opposite side of the hothouse, for the sake of comparison, there was provided a field of equal dimensions and with the same quality of earth, though left without any carbonic-acid supply. The spinach crop obtained with carbonic-acid fertilization was two and one half times, the potato crop two and three fourths times, the barley crop twice as much as corresponding crops grown without gas.

The farmer applying the process in actual practice has nothing else to do but to turn the tap of the carbonic-acid supply whenever required. Experiments so far made show that carbonic-acid fertilization of the air is far more effective than the usual fertilization of the soil. The process, moreover, augments the power of absorption with regard to the usual fertilizers.

To test the efficacy of carbonic-acid gas on plants growing in the open, crops were surrounded by perforated pipes containing the gas

In the hothouse experiments plants grew more than twice as well in the carbonic-acid houses as without the gas

The Electric Mule Now Pulls French Barges

ALL alone, without even a driver, a small tractor travels up and down the banks of the St. Maurice canal in France, dragging behind it a heavy canal-boat. What makes it keep to the straight and narrow path? Cables, a balancing arm, and the principle of the resultant of two forces.

The tractor, as you see, runs on large flanged wheels; it is propelled by a motor that gets its power from an overhead trolley. There are, however, no tracks in the ground to guide it; hence the cable system. How does this system work?

First, there is a fixed cable that passes over vertical wheels located at the front and at the back of the machine. This is the main guiding cable. But suppose it were the only one—what would happen? The heavy boat that the tractor pulls would tend to swing the rear end toward the river, thus putting extra strain on the machine and plowing up the ground over which the broad wheels travel. To eliminate this tendency, a second cable and a balancing arm are used.

The arm is rigid, and is connected at the front of the machine while the end of it travels along the second cable.

The towline is also attached at the front of the machine, but passes between two small rollers at the end of the balancing arm. Thus the pull exerted by the boat is absorbed by the arm and the second cable.

It has been found that this small electric tractor is both faster and cheaper to operate than most towboats and tractors.

Another advantage of the tractor is that it will travel anywhere — around sharp curves, under bridges—and without stopping.

Guided by cables, this tractor hauls heavy barges through the St. Maurice canal, France. It gets power from an overhead trolley

What Makes a Champion?

Not the form of an Apollo but the invisible relation of brain to muscle

By Eugene White Nixon

Time on the board, the force exerted in jumping, and the divers' nervous condition, are recorded by this device

NEARLY every follower of sports has a theory to account for any unusual ability in athletics. But very few of these theories are correct. We are told, for example, that Babe Ruth's success as a home-run hitter is due to his fine eyesight, or to his unusually powerful wrists. But it isn't true.

The difficulty is that the average follower of athletics thinks that athletic skill depends upon some physical peculiarity of the athlete that can be seen, or upon his peculiar way of going at his event. The truth of the matter is that athletic skill depends almost entirely upon invisible physiological and psychological peculiarities of the athlete that, of course, are not visible.

Most of us feel that the athlete should look the part. And sometimes he does. Often he does not. Athletic ability depends more on what a man has *inside* of him than it does upon what he looks like from the *outside*.

That is the reason it is hard for you to understand why the Apollo you picked to win the half-mile race fell on the back stretch and rolled in agony, holding his suffering stomach with both hands, while a scrubby kid with bristling hair and a million freckles dashed out from the ruck and smashed the tape thirty yards ahead of the bunch.

Brains Make an Athlete

But all this is easy to understand if once we comprehend that athletic ability depends, not upon the size, shape, or proportions of the body, but upon quick reaction time, fine muscular coordination, an efficient circulatory system, and an athletic temperament. And we should remember that none of these requirements can be seen.

The athlete has a quick reaction. Reaction time is the time required for a sensation to travel to the central nervous system, together with the time required for the central nervous system to send a message to the muscles, and for the muscles to get into action after the message gets to them.

And the reason the champion athlete is so much faster than the rest of us is because it takes less time for a sensation like the sight of a good ball, or the sound of the starter's pistol, to reach his brain, and for his brain to send a message to the arms and legs to set them in appropriate motion. In other words, his reaction time is shorter than ours.

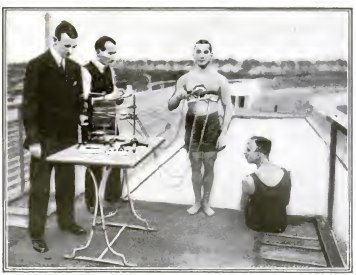
If you were at the bat, and Walter Johnson were burning them over the plate, unless you are a baseball player, you would probably be hitting at the ball after it was safely in the catcher's mit. Or if you were down on the starting-mark with Charlie Paddock in the hundred-yard race, he would probably leave you ten feet in the rear at the sound of the starter's pistol. And your trouble in both cases would be due to your reaction time. You must have a short reaction time if you are to be a champion athlete.

The Secret Is—Brains

How does Babe Ruth manage to pick out the good ones and bust them over the fence, while you and I can hardly see them going by? Why does Harry Vardon always get a perfect drive, while you slice every third one? How is it that Kolehmainen can run twenty-five miles with less distress than you run twenty-five yards?

What is the secret of athletic ability? Is it a matter of size, build, or muscles? Is it a question of heredity or of practice?

This article answers these questions for you.—Editor.



Recording the heart action, the blood-pressure, and the nervous condition as denoted by the trembling of the hand

Why Reaction Times Vary

Reaction time varies in length from a tenth of a second in the athlete to a full second in an extremely slow person. Small people are quicker than larger people, because sensations and impulses have shorter nerve trunks to pass over so that the reaction time is less.

Reaction time may be shortened by practice. You may be a slow runner and yet gain some speed by practice. But if your reaction time is naturally long, you will never win the hundred-meter race at the Olympic Games or become a world's champion fighter.

Muscular coordination is the second important requisite in athletics. Possibly coordination should be placed even before quick reaction, because there are a few athletic sports that do not require speed; but there is probably none that does not require good form for the highest success.

Good form in an athletic event means the most efficient way of performing in this event. We have

learned that, in order to get the best results in sprinting or in driving a golf-ball, we must have "form." And that means that all the muscles involved in the exercise must perform their duties in exactly the right way, at exactly the right time, and that, after performing their duties, they must instantly relax so as not to get in each other's way.

Perfect Coordination Means Success

This perfect team-work among the muscles is called coordination. And it is coordination that enables Harry Vardon to make thirteen pars, four birdies, and an eagle in an eighteen-hole golf-match. And the reason you and I slice the ball out of bounds is that we lack coordination.

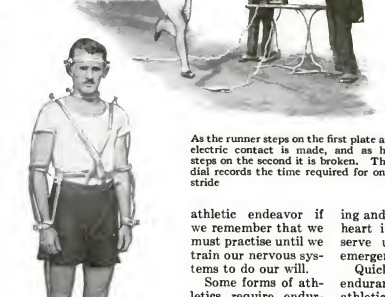
Coordination accounts for all athletic skill or "form." Quick reaction makes the athlete quick, but coordination makes him graceful. Coordination, and not powerful forearms or exceptionally good eyesight, makes the great batter. Coordination makes the great ball-player, boxer, wrestler, and even the fine dancer.

And the most important fact to note in this connection is that coordination is also dependent upon the nervous system. Muscles only perform as they are instructed to perform by impulses that come to them through the nervous system. And since a muscle can do only one thing — contract — there is no danger of the muscles going wrong if the right messages are sent to them.

Thus we see that training for form or skill in an athletic event is a matter of training the *nervous* system rather than of training the *muscular* system, as we are accustomed to think. That is the reason you cannot judge a man's athletic skill by looking at him—you cannot see his nervous machinery.

When we first attempt any complicated act like playing the piano or throwing the hammer or hitting a baseball or clamping on a half Nelson and a wrist lock, we are conscious of every move we make with the dozens of muscles involved. But, as we practise, the movements become more and more automatic until at last we simply *will* to do an act, and the thing is done without further thought. We have trained our nervous machinery to the point where it causes the proper muscles to contract at the proper time and with the proper force.

And it will help us to understand the performances of our great athletes if we remember that their nervous mechanisms are of so fine a quality, and so highly trained, that their muscles are enabled to work in perfect harmony, so that they get perfect results. And it will help us in our own athletic endeavor if we remember that we must practise until we train our nervous systems to do our will.



As the runner steps on the first plate an electric contact is made, and as he steps on the second it is broken. The dial records the time required for one stride

The athlete with electric lamps attached to his ankles, wrists, shoulders, and head. He is photographed with a motion-picture camera in movement with the lights glowing. Paths described by the lights indicate the motions made and the time in which they are carried out. The current can be broken automatically for one hundredth of a second, and the time involved in a movement can be determined by counting the dots, each representing one hundredth of a second. This is the cyclegraph, invented by Frank B. Gilbreth, an American efficiency engineer

Some forms of athletics require endurance, and this is the third quality of the athlete. And, like the other two, endurance does not depend upon any visible physical feature. You cannot tell by looking at a man how long he will last in a half-mile race or in a wrestling-match, because endurance depends mainly upon the heart.

The heart is to the athlete what the engine is to the automobile. The reason Hannes Kolehmainen, the Olympic marathon champion, can run twenty-five miles without distress is because he has a million-dollar heart.

Whenever we make a movement of any sort, it involves burning or combustion of fuel in the working muscles, just as we have combustion in the working engine of the automobile. Now, the heart furnishes the fuel for the muscles in the form of oxygen and bacon and eggs, and it also carries away the waste products of combustion. It performs both of these functions through the medium of the blood. And when we are out of breath or exhausted, the probabilities are that we are not exhausted at all, but that the heart has simply not been powerful enough, nor enduring enough, to keep up a sufficient flow of blood to meet our needs in an emergency.

Thus we see that we cannot determine by sight which athlete has the greatest endurance. Your Apollo who should have won the half-mile race probably had a leaky valve in his heart, or his heart was flabby from lack of proper training. And the reason he had to lie down on the back stretch was that he got choked up with carbon dioxide until it literally smothered him. And the scrubby-looking kid who broke the tape yards ahead of his nearest rival did so because he has a heart that drives the blood through his lungs and legs at terrific speed and under enormous pressure.

We ought, by clean living and moderate exercise, to keep the heart in such condition that it will serve us efficiently in all ordinary emergencies.

Quick reaction, coordination, and endurance are the chief requisites in athletics; but, in addition to these factors, temperament also enters into the question to a large extent.

The Athlete's Worst Enemy Is Nerves

If Edward Ray were of the nervous type that is inclined to chew the bedclothes or to drink carbolic acid under the stress of circumstances, he would never have carried the American Open Golf Championship to England. Or if Babe Ruth and Jim Thorpe were constantly in fear of finding a man under the bed, they would never have set any records for busting baseballs over the fence, nor at busting holes in the opposing line. And if Benny Leonard were of the phlegmatic type, he might be drawing a pension of six or eight dollars a day at common labor instead of getting a thousand dollars a minute in the prize-ring.

In the main, we see that athletic ability depends upon the nervous system, the heart, and the type of temperament, and not upon the size of the chest nor upon the shape of the calves.

Adjust This Shaving Cabinet to Suit Yourself

A CABINET is mounted on a steel arm that may be clamped to table or wall. A swivel joint is provided so that the cabinet can be moved to the most convenient position. The mirror, which is also the door of the cabinet, may be placed at the best angle and held in this position.

After the shave, the "implements" are placed in the cabinet and the mirror is swung back into position over the opening.

Strange Tastes in Food

SAYS Brigadier-General Burton in the *Daily Mail:*

"I have eaten lizard patties in the West Indies, porcupine in India, and curried liver of tiger. Our soldiers in India used to like flying-foxes (bats).

"Food accepted in one country may be rejected in another; and the tiger will reject portions of a carcass that are eaten with avidity (in the form of haggis) by a Scot."

Solid Copper from the Mine

NATIVE copper crystallizes in irregular cubical forms, sometimes flattened, elongated, or round. It often is deposited around mine timbers or on iron objects, and is found in crevices between rocky masses.

Perhaps that was the origin of the huge mass here shown. Solid masses weighing four hundred tons have been discovered.

The mass hanging from the ceiling of this mine was so thick that, in order to dislodge it, the miners had to cut through it with an acetylene torch.

He Built His Garage in His House

IN Cincinnati there lives a man who owns a flivver and is proud of it. Unable to find a place in which to tuck it away at night, he built a garage in front of and underneath his house.

The house is a three-story wooden one, situated on a terrace, and set several feet back from the sidewalk. There is plenty of room for a two-car garage in front of the house when the steps leading up to the front door are built at the side.

Does the garage spoil the house? Look at the picture above and judge for yourself.

However, when the door of the garage is finished and put into place, the garage itself will not be as conspicuous as it is now. The extra space will be rented to some car-owner in the vicinity and before long the garage will have paid for itself.

Locating the Buried Water-Pipes Electrically

WHERE is that buried pipe? Right here, ten feet down and twelve feet from the curb, says this instrument.

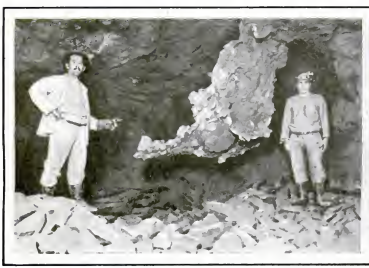
A weak alternating current is sent through the pipe. The connections are made in the house or building that the pipe enters. This alternating current sets up a magnetic field. A small exploring coil connected with a telephone receiver is then brought into use. A current will be induced in this coil when it is placed in the magnetic field, produced by the current in the pipe. This current will produce a tone in the telephone receivers.

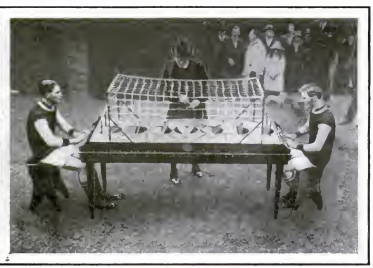
The strength of the tone will depend upon the strength of the current, and this, in turn, upon the position of the exploring coil in relation to the pipe. By listening to the tones in the telephone receiver, the exact location of the buried pipe may be found.

Footless Football

PLAYING football on a table—the latest sport in England. There is one man on each team, and he sits at one end of the table while his opponent sits at the other. The players do not even put their feet on the table as you would expect.

How, then, is table football played? With the hands. At each end of the table there is a keyboard that controls circular openings in the top of the table. By the rapid manipulation of the keys the ball is hurled backward and forward.





Morning Inspection in Jail

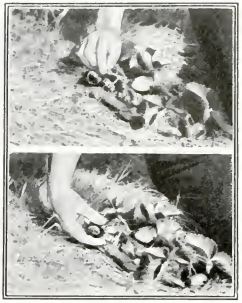
"HIS face seems familiar," says one of the masked detectives, as he looks over the morning line-up of prisoners in the Los Angeles jail. The prisoner's Bertillon measurements are promptly taken, and his identity soon established. This method of checking up the whereabouts of criminals is of great value in curbing the so-called crime wave.

Why do the detectives wear black masks that completely cover their faces? Because a detective's usefulness depends chiefly on his remaining an unknown quantity to the criminals around town.

There's a Right and Wrong in Strawberry Picking

THERE is a right and a wrong way of doing everything. Below you see illustrated the right and wrong way of picking strawberries. Study both pictures carefully and the next time you spend your vacation in the country you will be able to pick strawberries as they should be picked.

Strawberries should not be pulled off the stem. The grip necessary to pull them off the stem will partly crush them. The stem should be pinched just above the point where it is connected to the strawberry. In this way the strawberry is gathered uninjured.



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Seaweed Sweaters and Stockings

SEAWEED is the latest victim of economists; new uses for it are being found constantly. The picture above shows it in its latest form—clothing.

Both the sweater and the pair of stockings that the girl is holding were made from seaweed that grows in China. Yet they look not unlike woolen garments.

Fine needles are also being pressed into service; and so are many grasses and leaves. At a recent exhibition of the Commerce Bureau in the Customs House in New York city many grass-made garments were shown.

Eggs Dipped in Boiling Oil to Keep Them Fresh

A BAD egg—why is it? The pores of the shell allow air to enter, and in time the air ruins the egg—just as it will ruin a can of peaches.

How can you prevent an egg from going bad?

By hermetically sealing it. Victor Clairemont, of Chicago, has invented a machine for doing this. A tray of eggs is lowered by means of a motor-operated chain into a pot of boiling oil. The oil sterilizes the shells and seals up the pores. The eggs are allowed to remain in the oil for a few seconds and are then lifted out again.

The "Spoken Picture"

WITH charts in use by the police in all large cities, it is possible to describe a person who has never been photographed. These charts, devised by Bertillon, are called the *"portrait parlé,"* or "spoken picture."

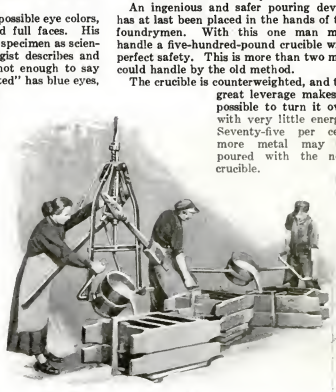
Bertillon classified all possible eye colors, hair colors, profiles, and full faces. His charts describe a human specimen as scientifically as an entomologist describes and classifies a bug. It is not enough to say that a man who is "wanted" has blue eyes, blond hair, and a lean face. The exact shade of blue, the exact degree of blondness, the exact shape of face, must be known.

New Crucible Eliminates Danger in Handling Hot Metal

POURING hot metal from an ordinary crucible is a hazardous job.

An ingenious and safer pouring device has at last been placed in the hands of the foundrymen. With this one man may handle a five-hundred-pound crucible with perfect safety. This is more than two men could handle by the old method.

The crucible is counterweighted, and the great leverage makes it possible to turn it over with very little energy. Seventy-five per cent more metal may be poured with the new crucible.



Forest Guide-Posts Made Here

WHEN spring comes, the foresters connected with the United States Forest Service go forth into the woods and plant guide-posts along the highways and forest trails.

Throughout the winter, when there is little work to be done in the forests, the men spend their time stenciling the names of towns and the number of miles between on seasoned boards. The boards are then given a preservative treatment to prevent them from deteriorating under severe weather conditions.

In the picture above you see a Western forester at work on one of the boards that later on he will plant on some trail.

Two Stories to This Cot

SLEEPING accommodation is one of the big problems of camping. Cots are heavy and they add greatly to the bulk of the "outfit." A number of cots also require considerable space, and this makes a large tent necessary.

An inventor has come to the aid of the camper with a cot that will accommodate four persons. It is really a double cot, one arranged on top the other. It requires only the space occupied by a single cot, that is, in ground space; the inventor has adopted the skyscraper idea of using air space instead.

Just a few minutes of time and very little labor are necessary to take the four-man cot down and fold it up.

Do Your Own Heel-Repairing

HERE is a detachable heel. A base heel with studs is fixed on the shoe. Its counterpart—the actual tread—is slotted to receive the studs. Draw out a small metal slide and you unlock the studs.

To put on the heel, you place it so that the studs will slide into the slots. Tap the bottom with the hand; then slide the metal strip, and the heel is locked into position.

When the heel begins to wear down on one edge, take it off and exchange it with that of the other foot. If the day is wet, put on your rubber heels. If there is ice, put on spiked heels.

This invention of Maurice Mayorowitz is a great convenience.

Rescuing a Flat Tire with a Roller-Skate

IF you run on a flat tire, you will soon ruin it. This holds good for bicycles as well as for automobiles.

If you are forced to use your bicycle when the front tire is flat, tie a roller-skate to it. The skate will follow the dictates of the rear wheel as effectively as the front wheel did. The tire will be protected from all contact with the ground.

The small boy in the picture thought of this solution to his bicycle troubles after watching several disabled automobiles suffering from broken axles and other ills being towed along with trucks under the wheels.

Beans Four Feet Long

BEANS by the yard. That is the way they would sell them if they grew like this. Here is a bean-pod that contains enough beans to fill a hungry man. It is just four feet long. The average pod is four inches long. A simple calculation shows that this big pod is equivalent to just twelve ordinary pods. That figures out about six large pods to the meal for the average family.

The overgrown pod is, of course, a freak and it "just happened" with no apparent reason.

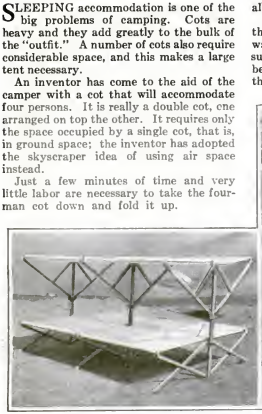
The soil it was raised on was very rich, but this does not furnish an excuse for such abnormal growth.

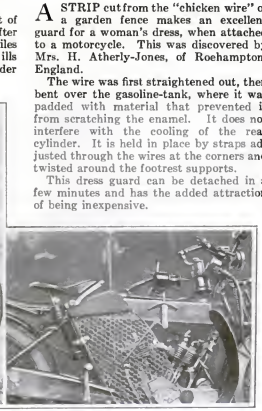
Fence Wire for a Dress Guard

A STRIP cut from the "chicken wire" of a garden fence makes an excellent guard for a woman's dress, when attached to a motorcycle. This was discovered by Mrs. H. Atherly-Jones, of Roehampton, England.

The wire was first straightened out, then bent over the gasoline-tank, where it was padded with material that prevented it from scratching the enamel. It does not interfere with the cooling of the rear cylinder. It is held in place by straps adjusted through the wires at the corners and twisted around the footrest supports.

This dress guard can be detached in a few minutes and has the added attraction of being inexpensive.





Transporting a Motorcycle by Elephant in Africa

ELEPHANT-HUNTING in British East Africa is conducted with tame elephants as a means of conveyance between camp sites. But when it is necessary to send runners from one place to another, the quickest way is by motorcycle.

Some trails are adapted to the use of motorcycles, but of course it is impossible to "blaze" a new trail with one. Then the domestic elephant is serviceable. The motorcycle is strapped on its side, and the hunters sit upon its head or back while it breaks its way through the underbrush. As a motorcycle does not weigh very much more than two hundred pounds, this is as nothing compared with the weight of the 1750-pound animal.

Turning Steel into Pig Iron

CONVERTING scrap steel back to pig iron is a valuable idea from France.

The scrap steel is charged from an upper level into an electric furnace. Then electricity is conducted to the furnace by an apparatus suspended from the wall. After the steel is melted, certain elements are added to increase the percentage of carbon, silicon, etc., and the mass is tapped out as pig iron.

A Shoe the Size of a Penny

SHOWN below is the smallest shoe we ever heard of. Its length is one inch and three quarters, the height one and a half, and the width only five eighths of an inch. It is so small that the English penny standing beside it assumes large proportions.

The shoe was made by a sergeant shoemaker in the English army. It is an exact replica of the military boot, even to the hobnails in the tiny sole.

Ermine from Rabbits

PURPLE velvet and ermine—that's what kings and queens wear. And for a good reason—ermine is too expensive for the rest of us.

There is, however, a rabbit that has fur that looks like ermine. Nose, paws, ears, and tail are black, while the body fur is white. These rabbits are now being bred for their fur, and are valued at about eighty dollars each. It is becoming fashionable to leave the black tails off ermine wraps; thus the job of imitating ermine fur grows easier.

Oxygen from a Tin Can

MANY a miner's life has been lost in a mine cave-in. When part of a shaft caves in, it frequently entraps a number of men, cutting off their air supply.

To prevent the loss of life by this cause, the United States Bureau of Mines has developed an emergency breathing device that will supply entrapped miners with the vital life-giving oxygen for several hours, often long enough for the rescuing party to reach the prisoners.

This little breathing device takes the carbon dioxide out of the breath exhaled, and returns the oxygen content fit for breathing again. Carbon dioxide is a deadly suffocating gas.

To Pull Out a Lion's Tooth No Easy Job

WHEN a lion roars, he may have something to roar about. Take the case of Queenie, star lioness of the Brooklyn zoo. Even if she is more than seven years old and weighs somewhere in the neighborhood of nine hundred pounds, she couldn't help roaring when she had a toothache. One of her molars was very badly decayed. The doctor looked it over, and decided that it must be pulled. But how?

The details of how the thing was done are not lacking; Queenie was placed on her back and all four paws were securely tied by ropes to the sides of her cage. While her keeper held her jaws open with a thick stick, the doctor tugged at the tooth.

Something New in Electric Stoves

THE electric cooker illustrated here, which was invented by a German engineer, may be connected with any electric-light socket. The current passes through two, four, or more carbon plates that are immersed in the water contained in the tanklike base of the cooker.

The plates are placed parallel at intervals of about one eighth inch, and the electric current passing through the water, which acts as resistance, soon raises the temperature to the boiling-point. The heat may be regulated by raising or lowering the carbon plates in the water.

Two circular openings are provided in the top of the tank in which the cooking-pots or cans are placed. The hot water cooks or heats the food contained in these receptacles. At four amperes this apparatus will heat food in one quarter of an hour with a current consumption of 0.25 kilowatt hours.

Shower-Bathing in the Street

WHEN the thermometer registers nearly a hundred, the heat is almost insufferable in the narrow streets of the lower East Side of New York city. But in Jacob street there is one cool spot—as the horse in the picture above found.

It is at the place where two temporary water-pipes join above the street. The joint is not as tight as it should be, and as a result all who pass beneath it receive a shower-bath. The cold water is very refreshing, and the barefooted boys in the neighborhood delight in playing under it. The New York firemen frequently take pity on the children and give themshower-baths with the fire-hose.

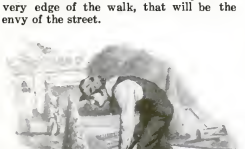
Give the Lawn a Clean Edge

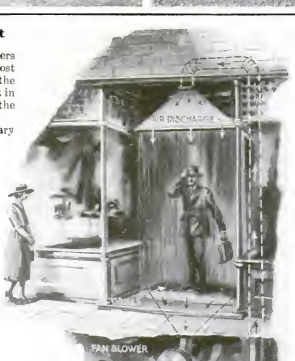
HOW many hours does it usually take to go along the edge of the lawn beside the concrete walk and nip off the straggling tufts of sod? The very thought almost makes one's back ache.

Run the remarkable trimmer shown in the picture along the edge of an eighty-foot lawn, and it will take just twenty minutes to make a clean job.

The cutter looks like a queer kind of shovel.

The trimmer digs a U-shaped trench between the sod and the concrete, delivering the cutting on the walk, where it can be removed expeditiously. The result is a neat and attractive lawn, clear up to the very edge of the walk, that will be the envy of the street.





Nothing but Wind to This Door

ONE of Boston's residents, Mr. Henry Cummings, has invented a wind door that will keep out flies, snow, rain, cold, and hot air, and yet will admit people without blowing their clothes or otherwise inconveniencing them.

The wind is created by an electric fan that is located directly beneath a grille in front of the entrance. It sucks in the air, sends it through a tube to a place in the ceiling above the grille, and from thence hurls it out.

Quicklime for Dynamite

SHOULD you wish to get rid of an old masonry wall without using dynamite, first drill in the wall a bottle-shaped hole having a small opening; till this with lime, add enough water to slake it, and close the hole with a snugly fitting wooden plug.

The resultant pressure will easily take down the wall.

Exit the Man-Propelled 'Riksha

IT is true that the old man-drawn 'rikshas still jog along the roads of Japan, but it will not be long before the motor age invades that country. In fact, it has started.

The first motor-propelled 'riksha has made its appearance on the streets of Tokio. Here it is. Sort of a freakish-looking thing, but it manages to get over the road all right.

A one-cylinder gas motor is attached to the rear wheel. This gives sufficient traction to push the light 'riksha with its three occupants over the road. It will cover many miles for a few cents.

His Cheese-Grater Mask

BOYS are not daunted by the high cost of baseball togs. They make their own gloves, masks, and chest-protectors.

Take, for example, the enthusiastic catcher below. He took his mother's cheese-grater, cut holes in it, and used it for a mask. From the neck up he looks like a jack-o'-lantern, but he doesn't care.

A piece of cardboard (stuffed, of course) serves him as a chest-protector, and strips of oilcloth make his leg-guards. His glove is an old cap with a piece of leather sewed inside and some cotton batting between the two.

Tuberculosis in Cattle Revealed by Eye Test

AN eye test for detecting tuberculosis in cattle has the approval of the scientists of the Bureau of Animal Industry, United States Department of Agriculture.

It happens occasionally that an animal will pass the older tests, but will react to the eye test. The eye test, therefore, furnishes an additional safeguard when used in connection with the older method.

Two tuberculin tablets are placed beneath the lower lid of the left eye. Observations are then taken at approximately the third hour following, and at frequent intervals up to twenty-four hours. Reaction to the test is indicated by discharge and swelling.

Once a Battleship—Now a Crane

THE venerable United States battleship *Kearsarge*, will live on in active naval service as a mighty self-propelled floating crane.

The crane mounted on this vessel can handle weights up to 250 tons, and even more. The *Kearsarge* will proceed under her own power from shipyard to shipyard to do the heavy work of juggling guns, turrets, armor-plates, and boilers.

The crane has a revolving, hinged jib, electrically operated. It can rotate 360 degrees, and hoist a load from 40 feet below the crane base to 103 feet above it, while by luffing the jib, without rotating the crane, the load may be moved through a horizontal athwartship range extending from 72 feet to 101 feet from the crane's rotation center.

Taking the Curl Out of Curly Hair

WHILE some women are going through the tortures of the permanent waver, others are clamoring for a permanent straightener.

It's simply a question of wanting what you haven't got.

In England, now, hairdressers are using the steel rollers shown below on many women who have naturally curly hair that they want straightened.

The rollers are held together by spring pressure; thus, when the hair is passed between them, it is ironed out considerably. There are small holes in the entire surface of each roller through which olive oil percolates.

The combination of the ironing, the oiling, and the previous washing of the hair in a softening mixture, will remove the objectionable wave.

It Leaves Both Hands Free

FASTENING a swivel clamp on the ordinary flash-lamp adds to its usefulness. It really makes a workman's tool of it.

With this lamp, a man may use both hands and yet play a beam of light on his work.

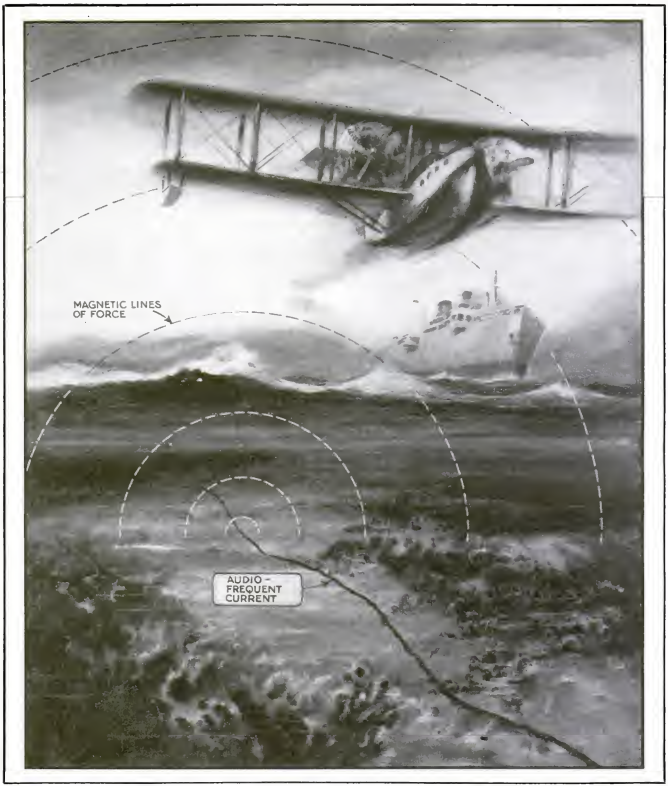
The little clip holds the light to the workman's belt. It may be adjusted to any angle and it will remain in this position until it is changed.

The light may also be placed on a wire or a nail. This is another feature that adds greatly to the convenience of the flash-lamp.

Gravity Aids the Foundry

IRON pipes used to be cast with the molds lying on their sides. It has been found more efficient to cast the pipe with the molds mounted vertically. This brings about a better distribution of metal within the mold, and consequently sounder castings are produced that do not have any blow-holes in them.

Casting the pipe-lengths in a vertical position also facilitates pouring the metal. The big heavy crucible containing the molten metal is handled with an electrically driven crane. Pipe-lengths as long as twelve feet are cast by this method.

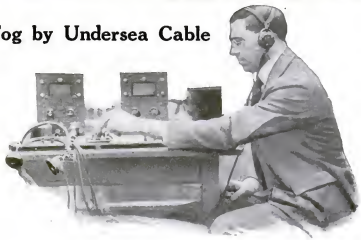


Airplanes Guided through Fog by Undersea Cable

LIGHTHOUSES and automatic buoys are now used to guard the treacherous parts of our coastline and harbors. In place of a warning flash of light or the shriek of a siren, a single cable with an oscillatory electric current surging through it will soon be used.

The cable will be placed at the bottom of the sea, and the current passing through it will set up a changing magnetic field. Seaplanes and vessels passing over the cable will carry two small coils. These coils will "cut" the magnetic lines of force generated by the current in the cable, and an audible note will be heard in the telephone receivers connected with the coils on board ship. The maximum strength of the note will be heard only when the vessel is directly over the cable. In this way a ship may be guided safely through fog.

A small 500-cycle generator on the shore supplies the cable with current. Earl C. Hanson, who invented this system, is shown at the right with his apparatus



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Do Greenbottle Flies Cause Infantile Paralysis?

NUTRITION chemists at the Minnesota Agricultural Experiment Station, St. Paul, who these days are much interested in problems relating to diseases that grow out of deficiencies of one kind or another in the diet, have struck a trail of possible importance to the farmer, and, it may be, of grave concern to medical science as well.

These chemists have found evidence that seems to point clearly to a connection between limberneck of poultry, a disease that now and then makes serious inroads on poultry flocks, on the one hand, and hog paralysis, which persistently levies toll on the herds of swine-raisers, on the other hand. And E. W. Saunders, a Missouri scientist, asserts that the source from which these diseases spring is also that of the dreaded poliomyelitis, or infantile paralysis. It remains to be seen whether what the Minnesota men have discovered will in the end help to clear up the mysteries of the tragic infantile paralysis.

R. Adams Dutcher and Stanley Dean Wilkins, at the Minnesota experiment station, became interested in the problem of limberneck in poultry as a result of specimens sent in for investigation. They went after the theory that the disease was caused by the eating of the larvæ of greenbottle flies.

Specimens of the greenbottle fly were infected from a hog that had died of paralysis. Eight days later larvæ of these flies were fed to a cockerel. Limberneck developed, and the cockerel died

The carcass of a hog that had died of paralysis of the hind quarters was obtained. The head of this animal was placed in a screened cage containing specimens of the greenbottle fly, known to science as *Lucilia caesar*. Eight days later, 100 larvæ from the eggs of these flies, taken from the head of the hog, were fed to a White Leghorn cockerel. Limberneck symptoms developed, and the cockerel died. The body of this bird was in turn placed in a cage containing *Lucilia caesar* flies, and the larvæ from the carcass were fed to a Rhode Island Red chick. The chick died the same day, after showing definite limberneck symptoms. The body of this bird was used for the development of still another crop of greenbottle larvæ, and these, when fed to a White Leghorn cockerel, brought about limberneck symptoms, though the chick recovered. Larvæ from another chick that had died of limberneck were fed to guinea-pigs, and the pigs, after being stricken with paralysis of the hind quarters, died.

Dr. Saunders, of Missouri, already mentioned, says that the greenbottle fly feeds on the carcass of a victim, and becomes potentially infected. After three days the eggs deposited are virulently poisonous. The creature that receives the larvæ from such eggs within a few hours, or certainly within a few days, becomes the subject of motor paralysis and death. Dr. Saunders even suggests the possibility already referred to—that the poisons which the greenbottle fly helps to create and distribute are the cause of infantile paralysis. But as to this the Minnesota men have made no investigations.

The Minnesota men, however, have gone far enough to place the greenbottle fly under grave suspicion.

Climbing a Rope as if It Were a Ladder

WITH the aid of an apparatus invented by a French house-painter, any person of average strength could climb a rope without great difficulty. Should he become tired on the way, he could rest by sitting in a sling.

The principle of the invention can be illustrated by suspending a rope from the ceiling and passing it through a ring. As long as the ring remains horizontal, the rope will slide freely through it, but if the ring is changed to a vertical position, it will grip the rope firmly at two points.

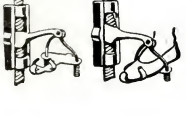
The climbing device consists of a metallic tube split open, and has a ring with a lever extension pivoted in the open space. To the end of the lever a pedal for the foot of the climber is attached. The rope passes through the tube and through the ring pivoted in the slot of the tube. Tube and ring will slide along the rope as long as no weight rests on the lever. When the climber rests his foot on the pedal, the ring changes its horizontal position, giving a sharp turn to the rope.

The pedals on this climbing device are so arranged that as long as the climber's feet move, the pedals move; when the climber rests, the pedals grip the rope, supporting the climber

The powerful grip of the ring on the cable enables the climber to rest his entire weight on the pedal on one foot and to move his other foot, equipped with a similar device, to a higher position.

For the hands, a similar tube with pivoted ring is provided that is merely used to steady the body of the climber.

In descending, an upward pull on a wire attached to the pedal levers allows the rings to slip down the cable, but the descent may be stopped instantly by releasing the pull on the wire or by pressure on a pedal.



Tropical pond-lilies may be grown in a temperate climate if the water in which the lilies are planted is heated

Warming the Water for Tropical Lilies

IN the Belvoir Park at Zürich, Switzerland, there is a tropical-lily pond—shown above—heated by coils of hot pipes lying on the bottom of the pond. The pipes are connected with two boilers located in the gardener's lodge. Throughout the summer months when the lilies bloom, the water in the pond is kept at a temperature of from 80° to 85° F. And in the wintertime one of the boilers is used for heating the gardener's lodge.

In the rose-garden of Prospect Park, Brooklyn, New York, there is a somewhat similar pond that has been heated in this manner for the past twenty-five years.

Fight the Rat Menace with Poison

ALL over the world the rat has made itself hated for its persistent spoliation of food and its carrying of disease. In recent years well organized campaigns have been carried on in various countries against this serious menace to the human race.

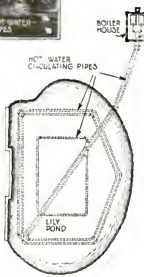
Poisons most often used in this fight are arsenic, strychnine, phosphorus, and barium. Out of doors, strychnine is to be preferred where it can be safely used.

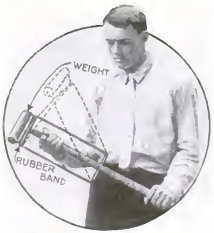
In buildings barium carbonate is recommended, because, while rats are killed by as little as one and a half grains, it is comparatively harmless to domestic animals.

Large numbers of rodents have been killed by phosphorus in Australia, while in Japan and the Philippines white arsenic has been used, and elsewhere lead arsenic. Although many rat poisons are made up of more than one poison, it is now recognized that a single poison is generally more effective.

Baseball at Home for Exercise

OUTDOOR exercise, of course, is the best in the world. Tennis, golf, football, baseball—what healthy young man (and nowadays young woman) would not wish to spend part of every fair day in the pursuit of one or more of these games? But, alas, when one lives in a city flat, and spends most of one's time in an office, there is scant opportunity for such exercise. If this is your condition, and if you would like to obtain without leaving your own room the muscular development usually obtained by swinging a good bat outdoors, here is an invention that will deliver the goods.





An indoor exerciser that acts in two capacities—that of bag-puncher and also as a ball and bat

Charles H. Reynolds, of Hermosa Beach, California, has patented an apparatus consisting of a suitable handle to which is fitted a swinging steel frame. A rubber band of sufficient strength across the end of the "bat" permits the frame to swing from side to side as the stick is operated backward and forward.

A suitable weight at the end of the frame serves as the "ball," which can be batted in one's room without danger of its flying through the window-pane or into the mirror.

The apparatus also acts as a punching-bag.

Five Thousand Pounds Hurled into the Air

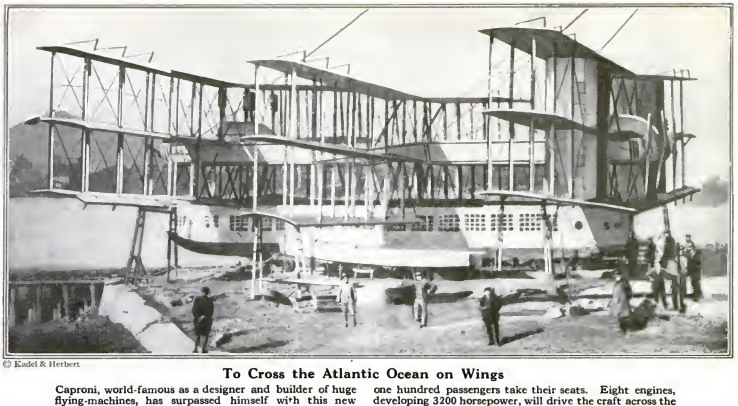
Instead of oil, this well spouted a stream of gas. It took the drillers' tool-kit on a skyward trip

DRILLING for oil is a gamble. It may turn out successful or it may not. Dame Nature has more to say about this than the drillers. When the drill gets down into the earth far enough, something exciting usually happens. If a sudden rush of oil mounts skyward, there is great joy at the camp. If there is merely a whiff of gas, everybody is dejected.

The picture shows one of these disappointments.

When the drill reached a depth of fourteen hundred feet, there was a terrific rush of gas. The drill had punctured a subterranean pocket where gas was stored under tremendous pressure. It was just like pricking a toy balloon with a pin. The gas rushed to the surface and carried many of the well-drilling tools with it. The black streaks in the photograph represent drills, wrenches, sledge-hammers, and crowbars. These shot skyward, together with a mass of tangled rope. Just five thousand pounds of tools took this trip on the top of the gas cushion. If a man had been over the hole, he would have followed the tools.

The natural gas that spouts through the "oil-well" is very volatile and therefore highly inflammable. Care has to be taken that it is not ignited. It may be months before gas pressure drops to allow drilling to continue.



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To Cross the Atlantic Ocean on Wings

Caproni, world-famous as a designer and builder of huge flying-machines, has surpassed himself with this new giant. Nine planes support a sixty-six-foot hull in which one hundred passengers take their seats. Eight engines, developing 3200 horsepower, will drive the craft across the ocean at a speed of at least sixty miles an hour

Caproni Builds a Transatlantic Flying-Ship

Nine planes are to carry one hundred passengers in a cabin with wide windows

CAPRONI, the famous Italian designer and builder of airplanes, a man who dreams of aerial navigation on a grand scale, has built the biggest airplane that any one has yet ventured to construct. Those who saw the huge bombers that he built during the war, multiplaned machines with spans of about 100 feet, gasped at his daring. But now he exhibits to us a flying-ship with which, he believes, the Atlantic ocean may be crossed in not more than a day, and in the completely enclosed hull of which a hundred passengers find comfortable accommodation.

The building of so huge a craft means more than the magnification of an ordinary biplane or triplane. This machine weighs twenty-four and one half tons, we are told. If it were to alight on land at so low a speed as forty miles an hour, the impact would be terrific. Indeed, this problem of landing has been one of the most difficult to solve by the designer of big land airplanes. Curtiss, who built the *America* which was to have flown across the Atlantic just before the war broke out, and which had a span of about 130 feet, appreciated the difficulties correctly. Accordingly, he made the *America* a seaplane. It is easier to alight on water than on land.

Caproni, looking back at his own experiences with heavy land machines, has, evidently decided that Curtiss' policy is right; for his huge craft starts from the water and alights upon it. For all that, he encountered trouble. In one of the first short trial flights on Lake Maggiore in Italy, the hull was damaged as it struck the water, showing that even impact with a fluid that can easily be displaced is not without its dangers.

To lift a weight of twenty-four and a half tons, a huge wing surface must be provided, in this case 7150 square feet. A single pair of superposed wings, such as we find in the ordinary biplane, could hardly carry so huge a load. The span would be enormous, so much so that it would be far more difficult to make the wings strong and stiff enough than to build a bridge. Hence, Caproni built three superposed wings, thereby cutting down the span. But evidently two sets of triplanes were not enough, according to his figures. He has supplied three sets, with a veritable forest of struts to tie them together and a maze of wires between. All this means wind resistance, and therefore low speed, despite eight engines developing a total of 32000 horsepower. No definite figures of performance have reached us from Italy, but it is doubtful whether more than sixty miles an hour can be made.

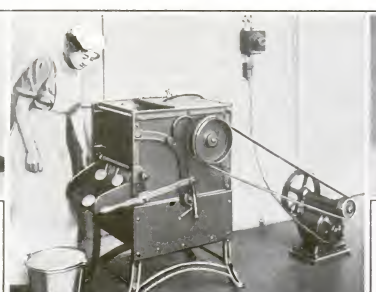
Below the wings is the passenger cabin, or hull. Its interior is more like a railway-car than a ship. It has wide windows and comfortable seats.

Those who have studied the commercial possibilities of aerial navigation will naturally compare Caproni's nine-planed flying-ship with a rigid dirigible of the Zeppelin type. Caproni can probably build a transatlantic flying-ship at a smaller cost than the Zeppelin Company can turn out one of its 600-foot dirigibles. But it is a question whether, in the end, the dirigible will not prove commercially more practicable. The speed of a Zeppelin would certainly be as great as, if not greater than, that of the giant Caproni. It could carry fully as many passengers. It is not utterly dependent upon engine power for support; for it can float in the air for hours while repairs are being made. On the other hand, the Zeppelin needs an expensive harbor or shed in which it can be housed, or, better still, a tall mooring-tower from the top of which it can swing in the wind.

The experiences of the Germans with the *Bodensee*, the huge Zeppelin that was plying regularly last year between Berlin and Switzerland, and which rarely flew with an empty passenger-seat, lead one to the conclusion that, all things considered, the advantage lies all with the dirigible for long-distance commercial flying.

Housekeeping Made Easy

A tiny coal-stove that will fit over one of the holes of the regular stove has been invented. The lid is removed from the large stove to supply the draft

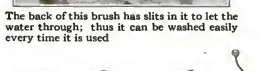


Here is a machine that will wash, peel, and wash again, three hundred pounds of potatoes in an hour. Knives that revolve rapidly scrape off the skins

Inside of one end of this shoe-brush there is a tube of shoe polish. When the cap is taken off and a key turned, the paste oozes out on to the bristles

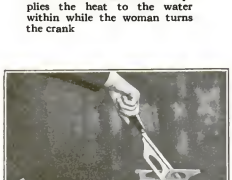
A coal fire is built in the small compartment beneath the tank of the clothes-washer. It supplies the heat to the water within while the woman turns the crank

The back of this brush has slits in it to let the water through; thus it can be washed easily every time it is used



Pressing trousers by electricity is the latest labor-saver. You clamp the trousers between boards and turn on the "juice"

Here is a dish-washing stand that is connected by tubes with the hot- and cold-water pipes. When it is opened, the cover is used as a tray for holding the dishes



Can you cut a pie evenly? If not, use a knife of many blades like the one shown above. It is fastened to the edge of the plate and will quarter a pie at one stroke

Hot air in winter and cold air in summer are supplied by this electric fan and heater

Bottles that contain poison should be different from other bottles. Here are some shown at a chemists' exhibition; the one lying down can't stand up

Keeping Up with the March of Science

Facts for the man who wants to know

More About Living Forever

JULIAN HUXLEY, a descendant of the famous Thomas Huxley, has been making some experiments that throw a great deal of light on age and growth. He kept a flatworm at the same age for a time during which the rest of the brood passed through nineteen generations, and this merely by alternate starving and feeding. Translate these nineteen generations into human terms—we are back in Chaucer's time.

Huxley has succeeded in prolonging the life of rats by about 40 per cent. But, alas! all this applies only to flatworms and rats.

Chemical Analysis Is Slow

SCIENTIFIC methods have made such rapid strides in recent years that the public, ignorant of the difficulties of research work, bas come to expect too much.

If a can of ox-tail soup were sent to a trained chemist for analysis of its chemical constituents, including spices, preservatives, and coloring matter, most business men would expect him to produce a full report within twenty-four hours.

As a matter of fact, it would require a dozen chemists, working continuously upon the problem for a dozen years, in the best equipped laboratory, and they would use up tons of soup.

Diphtheria from Cats

CATS have been studied frequently as possible carriers of contagious diseases. Recent investigation along this line has tended to prove that the household cat is a dangerous carrier of disease germs.

A worker in this field recently isolated virulent diphtheria bacilli from two cats that had been pets of a person who had contracted the disease. The germs are carried in the fur of the animals.

The cat is not the only offender. Dogs and other household pets are also carriers.

Testing Paint with Light

ULTRA-VIOLET light has a marked chemical effect. It is the ultra-violet rays in the sunlight that produce sunburn, and that cause paint on houses, fences, etc., to fade and drop off.

By exposing painted surfaces to a rich source of ultra-violet light, the effects of months' exposure to the light of the sun may be had within comparatively few hours.

Yeast for Half-Tone Blocks

ACCORDING to the Paris daily press, it appears that compressed yeast is to be used for making up half-tone printing-blocks. In the usual practice, the half-tones have certain disadvantages in the matter of cost and difficulty of preparation, and are easily worn out.

A process now comes from Germany in which it is proposed to use compressed yeast as a plastic material for making the half-tone blocks. But the fine point of the process consists of a newly discovered method of treating the compressed yeast with various chemical products among which formol is found to be the best. It is then wholly or partially dried and compressed at a moderate heat, thus producing a compact mass that possesses a remarkable degree of hardness. The mass, which is at first in the plastic state, is compressed upon the negative plate and is employed instead of more expensive plastic material.

About Vitamines

IT has been discovered that the vitamines contained in our food are essential to life. Without them scurvy and other diseases are brought about. Auguste Lumière has been trying to find whether this also holds true in the case of plants. His experiments lead him to believe that this is not the case.

It appears that microbes may be readily cultivated in mediums of strictly mineral composition. Lumière boiled beer yeast, which is rich in vitamines, and found that the beer yeast had lost all of its vitamine power. However, fungi were found to grow rapidly in a broth made of the boiled beer yeast.

Starvation a Long Process

THE death of the Mayor of Cork after voluntary starvation of seventy-five days revived interest in the problem: how long can a human being live without taking food?

Resistance of a human organism deprived of food depends upon the reserve supply of fat which that particular organism has stored up.

In the last thirty years several men made the experiment of fasting for long periods. Succi abstained from food for thirty days, and in that time lost 19 per cent of his weight. Dr. Tanner, under strict surveillance, fasted forty days.

A remarkable record was that of the artist Merlatti, who abstained from food for fifty days. After the first five days of fasting came a long period of severe depression and weakness, accompanied by loss of temperature that compelled him to remain in bed for the rest of his fast.

Persons in a state of lethargy produced by sickness or artificially brought about by hypnotism have been able to survive complete abstention from food for much longer periods. The most remarkable instance is that of Anna Garbero, who lived thirty-two months and eleven days without taking food or drink of any kind.

How an Egg Conquered Moss

DURING his sojourn in the south of Europe, a French naturalist had the rare opportunity of observing an intensely interesting struggle for existence between an egg and a moss plant.

The egg was that of a lizard which had been deposited on a cushion of moss. It was enclosed by a white protective covering of leatherlike toughness. The moss on which the tip of the egg rested, secreted at the point of contact a substance that gradually dissolved the leathery shell of the egg. When there was no longer any resistance, the stem of the moss plant penetrated the shell and sent its branches through the substance of the egg, emerging at the opposite end.

But the egg was equal to the emergency. It enveloped the stem of the moss inside the egg with a membranous coating that formed an insulating tube around the intruder. Then the moss sent out side branches through the egg, traversing it, but these also were made inocuous by an albuminous coating. In spite of this struggle against the intruding moss, the lizard embryo developed to all appearances normally and finally emerged from its prison unharmed.

Power from the Sun

OUR sun sheds five thousand horsepower on every acre of land in the tropical regions of the earth. Efforts were made to harness this great force as far back as 1615, when de Caux attempted to make this power available for the use of man.

Large reflecting surfaces have always been used, and a solar plant was once built on this principle in Egypt. However, the efficiency of the plant was very low—only sixty-three horsepower an acre. It is possible that in the future the power of the sun will be made available through the use of the photo-electric cell, which generates an electric current when light falls upon it.

Writing Music a New Way

SEVEN white notes and five black notes on the piano make up the chromatic scale. Professor E. V. Huntington suggests that this be changed to six of each.

Why?

To assist in the simplification of music reading and writing. In connection with this, Mr. T. P. Hall suggests that the staff be changed; instead of five lines there should be six—allowing a line or space for each note of the chromatic scale. Thus sharp and flat signs will be entirely eliminated.

The lines of the staff will correspond with the black notes on the piano, and the spaces will correspond with the white notes. A further suggestion is that the notes in the key of C be corrugated so that

they will be recognized easily hoth by sight and hy touch.

This system will undoubtedly simplify the study of music in some respects, hut it will cause complications for those who learned the old way.

Where Did Life Originate?

"LET the waters hring forth abundantly the moving creature that hath life." So runs Genesis. Many scientists helieve that life originated in the sea, since the sea and the air contain all of the substances present in the human body. Even today it is the ambition of nearly every creature of the sea to tackle the dry land.

Professor Thomas, an English naturalist, claims that the desire of the animal kingdom has been to get out of the water. To accomplish this, many of the creatures have overcome difficulties that would appal the heart of the bravest man. Did this strong desire, persisting throughout the ages, hring ahout the development of a creature that had legs in place of fins? If so, man had his beginning in the form of a little creature that braved the dangers of the dry land to satisfy a desire to leave the haunts of the deep.

Wireless Photographs

PHOTOGRAPHS have been sent over telegraph wires and some experiments have also heen made with the wireless transmission of photographs. However, the wireless transmission of photographs has not heen satisfactory and much work remains to be done.

It is true that some remarkable results have heen made with radio transmission, but nothing has heen done that would stand the test of commercial application. The prohlem of interference has heen a difficult one to overcome. The reception of stray waves during the sending of a photograph would cause an inaccuracy in the photograph.

Diet of Starlings

THE starling has spread over all the Eastern States and is becoming more numerous every year. To determine whether the bird is useful as a destroyer of noxious insects, the biologists of the Department of Agriculture examined the stomachs of more than 2000 adult starlings and about 300 nestlings. The adult birds feed virtually all day and eat incredible quantities of insect food.

The young starlings, which remain in the nest from sixteen to twenty days after being hatched, are fed hy their parents at intervals of three to six minutes throughout the day of twelve hours and ohtain more than two thousand meals before they leave the nest.

During the first four or five days their diet consists principally of caterpillars, the soft larvae of beetles, flies, etc., and of spiders. Later they feed on millipeds, grubs, grasshoppers, crickets, and beetles. In the stomach of one young starling the remains of twenty-six clover-leaf weevils were found.

$1000 for a Horseshoe

DO you want to earn a thousand dollars? Invent a horseshoe that will prevent horses from slipping on icy or wet pavements.

The American Humane Association of Albany will give this amount to the lucky person offering the hest design before 6 P.M., July 1, 1921.

Not only will the inventor of such a device do a great humane act, hut he will also enrich himself to some extent. Details of the contest may he ohtained from the headquarters of the American Humane Association at Alhany, New York.

Cold Makes Plants Grow

THERE is a general helief that cold weather is responsible for the dormancy of plants and trees. This is not so. Mr. Coville, an experimental hotanist, has studied the growth of blueberry plants under controlled temperature conditions, and has found that cold weather is not responsihle for complete dormancy. Even after it is estahlished, the mere exposure of the plants to warm weather is not sufficient to restore normal growth. He has also found that plants will not he restored to a condition of normal growth unless they have heen exposed to a period of chilling.

Mr. Coville points out that the stimulating effect produced on dormant plants by cold is intimately associated with the transformation thereby of stored starch into sugar.

Gassing the Burglar

BURGLARS must soon add a gas-mask to their tool-kit. A device recently patented by R. C. Roeschel, of Harrishurg, Pennsylvania, will make the cracking of safes a hazardous joh unless the hurglars are thoroughly protected by gas-masks.

A number of glass containers are so arranged that they will break when the safe is tampered with or when an explosive mixture is set off to force the door open. The escaping gas works rapidly, and a few inhalations of a very small quantity of it will produce unconsciousness.

After being exposed to the fumes of the deadly gases there will be little chance left for the burglar to escape.

What Weather Does to Cloth

WEATHER conditions have a marked effect upon cloth. Silk resists weather much hetter than linen. It has been found that heat, light, and moisture weaken cloth of any kind, so that it becomes less resistant to tearing and changes its color.

Leo Vigon, a Frenchman, has found that the wearing of cloths depends largely upon the resistance of the material to weather conditions. Vigon tested different materials under controlled conditions of temperature, and light. He also conducted a numher of tests exposing the material to sunlight for various periods. In many of the tests the complete breaking down of the fiher was brought ahout hy exposure to perfectly natural conditions.

The next time you have to huy a new suit, hlame the weather for helping to destroy your old one.

War Tanks as Life-Savers

A BRITISH physician has suggested that tanks be used as amhulances during war. In fact, in cases of emergency, the tanks were used to hring in the wounded during the great war.

Tanks fitted up as amhulances could bring in wounded men with little danger from stray shells. They would have no trouhle in navigating roads that would offer the greatest obstacles to motor-trucks.

It is proposed that hammocks and stretchers be arranged in tiers, with an operating-table in the center.

Hailstones and Their Power

THE destructive power of hailstones has been carefully studied hy Paul Martin, a French scientist, in an attempt to ascertain the relation between the size and weight of the hailstones and their ability to kill birds, various larger animals, and human heings.

M. Martin found that hailstones greatly vary in size, from that of a pepper-seed to that of a baseball. The smallest spheres of ice weigh hut a few grains, while some of the largest on record reached a weight of seven or more ounces. Martin determined by observation and calculation that hailstones weighing eight grains or more kill small hirds, those weighing twenty-three or twenty-four grains are fatal to quail, those of ahout forty grains to animals as large as a rabhit, and those attaining a weight of ahout two ounces will kill human heings.

Soil-Freezing Temperature

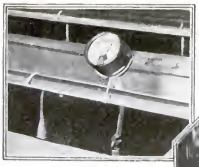
CAREFULLY conducted experiments have shown that soil will not freeze at zero temperature unless it is thoroughly agitated. If it is not agitated, it will not freeze at this temperature, no matter how long it is left exposed to it. Sand loam, if left undisturbed, may be exposed to a temperature of several degrees below zero without any sign of freezing. The thermometer has shown the temperature of certain soils to be far below the freezing-point without the soil's actually freezing.

News by Radio

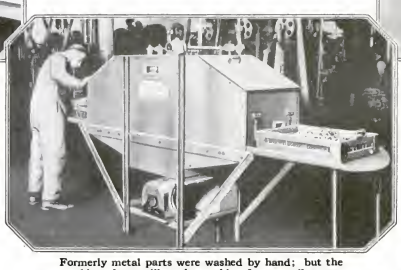
EXPERIMENTS conducted hy a news agency in England demonstrated that the distribution of news messages hy means of wireless telephony is still an unsolved prohlem. The voice was perfectly audible, but the transmission of messages took so much time and could be intercepted so easily that the system was ahandoned.

More promising were the experiments made to test the practicability of using high-speed wireless telegraphy for distributing news and commercial messages.

Do It with Tools and Machines



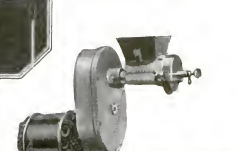
In electroplating, the amount of deposit depends on the density of the current around the article being plated. This can be determined by the foot-ampere meter above. It shows current density



Formerly metal parts were washed by hand; but the machine above will wash anything from small screw-machine parts to large castings. The parts are placed in wire-mesh racks and streams of water are poured on them

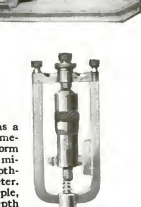
Here is a lathe dog that is fitted with a recess into which the set screwhead fits. Thus danger of breaking projecting screws is eliminated. It also prevents accidents since it cannot catch the clothes of the worker

A machine that will emboss gold or silver marks on cloth. The material is placed under the stamps, gold or silver paper laid on, and pressure applied



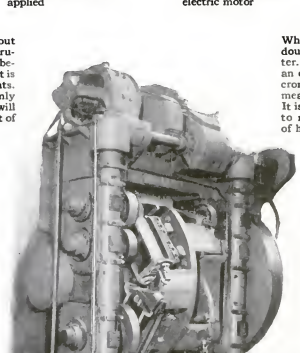
This grinder is provided with a number of grinding elements that enable it to grind material to different degrees of fineness. It is driven by electric motor

Not a microscope, but a measuring instrument. A steel ball is being measured here; it is held by three points. If it is not uniformly rounded, a pointer will indicate the amount of its deviation

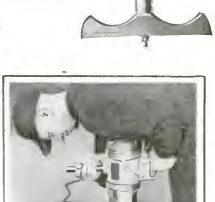


What is known as a double-duty micrometer. It will transform an ordinary inside micrometer into a depth-measuring micrometer. It is used, for example, to measure the depth of holes in metal

Heretofore emery wheels have been used for pointing the ends of bars before inserting them in screw machines; but the process is slow and costly, hence this bar-pointing machine



The machine above will mill the top and bottom of passenger-car cylinder blocks at the rate of two hundred and forty in an eight-hour day. It has a round drum that will accommodate fixtures for six castings



An electric drill equipped with a switch that operates like a pistol trigger. The handle is also shaped like the handle of an automatic pistol. It will operate on direct or alternating current

Patch Them while They Are Hot

SMALL electrical furnaces, gas furnaces, and crucibles are lined with a heat-resisting substance. When this breaks down, the molten metal touches the cold metal of the furnace or crucible, and there is trouble.

It used to be difficult to make a repair in the lining of a device while hot. This is no longer true, thanks to a new substance that has been placed on the market. This hot-patching material can be used as soon as the furnace has cooled down enough to allow a workman to come in proximity to it.

Industrial wheels move fast, and when machinery falls behind in the race through a breakdown, it is necessary to make a quick repair.

A Slide-Rule for the Pocket

A ROUND slide-rule—that is an innovation. The ordinary slide-rule is long and slender. This one is thin and circular. It is equivalent to a slide-rule six inches long, and it can be carried in the pocket, since it is light and requires little space.

There is nothing that the long slide-rule can do that this round slide-rule cannot do. In fact, it has an advantage over the usual type of slide-rule: it is designed and constructed in a way that it is not affected by changes in temperature. It slips into the vest pocket nicely.

Shoehorn, Buttonhook, and Lace-Tipper Combined

LOW shoes, buttoned shoes, laced shoes —all of them need accessories. There's the shoehorn, the buttonhook, and the device for putting tips on laces that have lost theirs.

All of these things are combined in the new instrument shown above. The button-hook and shoehorn members are hinged so that they may be folded together when not in use.

Each of them is grooved near the hinge so that when folded together a hollow space is formed. In this hollow space the tipping is done.

The metal tip is curved around the shoe-string by hand and is clamped in place in the manner shown in the picture.

Weighing in a Vacuum

IN scientific work it is sometimes necessary to weigh one part in 100,000,000. Such weighings are usually carried out in a vacuum.

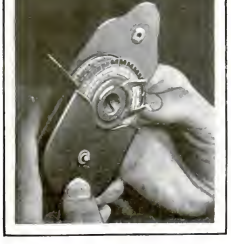
The need for making weighings in a vacuum arises primarily from the fact that, owing to its weight, air has a buoyant action on all objects immersed in it. On an equal arm balance, therefore, two objects of the same mass, but of different densities, would not balance each other in air. Moreover, the density of the air varies with the temperature, the pressure of the barometer, the amount of moisture present in the air, and even the quantity of carbon dioxide present. In establishing our working standards of weight, the buoyancy correction is most uncertain.

For all these reasons precision weighings are made in a vacuum.

The balance used by the United States Bureau of Standards is illustrated above.

A case is placed over the balance, and the air is exhausted. The readings of the beam are then taken through a glass window, the position and movement of the beam in making the weighing being determined from the image of a ruled scale reflected into an observing telescope, by a mirror mounted on the beam.

The fundamental standard of mass is a kilogram of platinum iridium, which is one of the densest materials known. This material was chosen for its hardness.



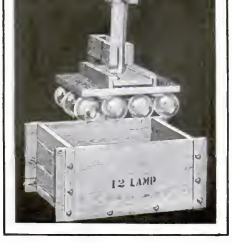
Bulbs Frosted while You Wait

WHEN you go into an electrical supply store now to purchase frosted bulbs, you will not be told to return in an hour or more.

A half dozen or a dozen bulbs may be frosted in the twinkling of an eye with the little lead-lined tank shown at the right and a special frosting fluid that acts quickly and leaves no disagreeable odor.

It is necessary merely to place the lamps in a rack, as shown, and then to dip them in the solution that has been prepared in the tank, immerse the bulbs for only a few moments, lift them out, and rinse them with clean water. They are then ready for the customer.

Experts have assured us that an unfrosted electric-lit globe is most harmful to the eyes.



A Simple Seed-Corn Tester

ABOVE you see a combination seed-corn dryer and germinator devised by an Iowa farmer. The ears of corn that have been selected for seed are stuck on nails on the frame, and left there until time to test for seed. Each nail is numbered.

The base of the drying-frame is made of sheet iron filled with small pockets. There are just as many of these pockets as there are nails, and they are numbered like the nails.

When the time comes to test the seed corn, the matter is easily and simply handled. Two kernels from each ear are placed in the cups, the corn from ear No. 1 going into pocket No. 1, and so on. When germination has been brought about by covering the sheet iron with a wet cloth, the kernels immediately show which ears are good for seed.

The Corral Travels Along with the Animals

WHO has not seen droves of stock going quietly along a highway, and, without apparent reason, suddenly dart into wood-lot, grainfield, or cherished lawn or garden?

The corral on wheels below obviates all these happenings and peacefully gets from six to twelve or fifteen cattle—depending on their size—to market or fair, as the case may be.

A larger number of sheep may be handled at one time with ease.

It is about ten by twenty feet in size, and in the rear is arranged a gate that is nearly the full width of the structure. Through this wide gate the stock enter the enclosure.

The stock once within, the owner mounts his blanket seat high on the rear fence above the gate, gathers up his long reins and they are all ready to start for their destination.

Covered with Pearl Buttons

IN the East End of London there lives a group of people known as costermongers. For years they have worn distinctive clothes with large pearl buttons. In spite of the fact that pearl buttons worn so conspicuously as in our picture are not fashionable, the costers refuse to give them up.

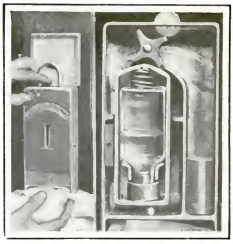
Below you see the coster of costers, Mr. Harry Crop. His best suit is ornamented with sixteen thousand pearl buttons. The buttons are sewed on so that they form various designs. On each trouser leg, for instance, there is a pearl button star with a heart beneath it.

The costermongers' womenfolk have a fondness for velveteen dresses and large hats trimmed with huge ostrich feathers.

Experiments in Rain-Making

RECENTLY some experiments were made by British aviators in the Transvaal in connection with the artificial production of rain. A biplane, into which were built two sand-boxes containing one hundred pounds of sand, flew above the clouds. The sand was rapidly released, the idea being to cause condensation of the clouds and resultant rain.

A Canadian experiment to the same end sprayed liquid air in the clouds. Neither of these schemes proved successful, but they were interesting to watch.



Perfume for a Nickel

DWELLERS in big cities are familiar with restaurants where it is possible to obtain a dinner by the coin-in-the-slot plan. There are machines that vend chocolates, chewing-gum, and stamps. Most of these slot-machines, however, have sold commodities that were sure to have a steady sale.

Now we are confronted with a perfume-vending machine, and the inexhaustible field of luxuries is opened up.

This invention consists of an inverted bottle and a spring above it. When a nickel is inserted in the slot at the top of the machine, a radial arm presses the coil-spring, which presses the bottle, releasing its stopper, and allowing a few drops of the perfume to fall on the handkerchief held at the outlet at the bottom of the machine.

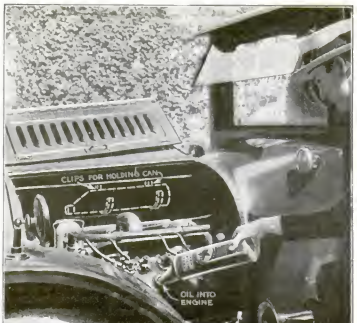
Riding the Boardwalk at Popular Prices

ECONOMY has at last reached the boardwalk. Many people who formerly rode in beach chairs at fifty cents an hour are now traveling on the electric car shown below at a fare of five cents a trip.

This car is merely a modification of the electric baggage-hauler that is seen in many railroad stations. It travels at the rate of eight miles an hour, and will hold about twenty people. Customers wheeling baby carriages may ride in the rear and trail the carriages behind them—no extra charge.

The driver will stop the car at any point to let people on or off.

On days when the boardwalk is crowded with people, the driver of this strange car must find it very difficult to wend his way through them.



Here is an oil-can with a special spout, enabling the user to avoid soiling his hands or clothes; it holds two quarts of oil

Two-Quart Oil-Can for Motorists

ONE of the newest conveniences for the automobilist is a two-quart oil-can that can be carried conveniently under the engine-hood on two clips hung from the hood rod.

The can has a special spout that enables the driver to pour the oil into the engine without dirtying his hands or clothes. With such a can the motorist need never run out of oil, nor be forced to buy an inferior grade or one not suited to his engine because he cannot purchase the proper grade along the road.

The can may be thrown away when empty.

Taking Out the Kinks in Rims

FEW jobs are so difficult to handle with the average garage equipment as the straightening of rim kinks. The new rim anvil shown below is the only device on the market that will take care of rims of every type and size. The anvil consists of a solid block of gray iron with a variety of grooves and faces to accommodate rims of every kind in a vertical or horizontal position. Two hand tools are used in connection with the anvil to straighten the rims against the different grooves.

Every type of rim presents a problem of its own. Driving to the nearest garage on clincher rims as a result of a blowout often results in bending the edges of the rim to such a degree that the beads of the tire cannot be inserted. In putting a new tire on a rim of the lock-ring type, the rim is often so pounded that it is impossible to insert the lock-ring. Split rims are apt to become so sprung that the lock cannot be forced into place with the ordinary tools at hand. The rims of wire wheels, which are extremely difficult to handle on account of their spokes, can be straightened most easily by the use of the new anvil.

This anvil for straightening tire rims consists of a solid block of gray iron having grooves and faces of various shapes for accommodating every kind of rim; two tools are used in connection with the anvil

The garageman will appreciate this device, as he knows, better than anyone, how often this job must be done and how much time and labor it takes.

This New Automobile Revives the Friction Drive

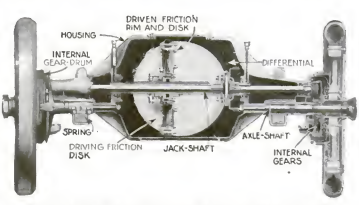
THE friction drive, which was used almost exclusively in the early automobiles, and in which the power of the engine is transmitted to the rear axle by the friction between two circular disks, one at right angles to the other, has been revived in a new make of automobile that, in general appearance, looks like any other. The friction drive takes the place of the regular gearset or gear transmission and the clutch of the conventional car.

Its chief advantage is that it permits of a large number of varying reductions with a very simple mechanism. The number of reductions available to suit the conditions of road, grade, and carload is almost infinite, although in actual practice these reductions are limited because the lever by which the driving disk slides across the face of the driven disk is held in position by a latch in a sector with a certain number of notches. However, the number of these is greater than three or four as obtainable in the conventional sliding gearset now in most common use.

The friction drive has two other advantages: the gear changing is noiseless at all speeds, and the shocks due to the grabbing or too sudden engagement of the clutch are eliminated because no clutch is necessary.

In previous forms of friction-driven cars the driving gears were generally placed directly in back of the engine with final double side-chain drive to the rear wheels as on some of the heavy sizes of motor-trucks. The objection of the noisy side chains has been eliminated in the new car shown herewith by placing the driving gears entirely within the rear axle, where they are out of the way and dirt-free.

The manipulation of the driving means is effected through a pedal located to correspond with the clutch pedal in the ordinary car. A ratchet holds this pedal in whatever position it is set, although by rocking it the ratchet is released and the pedal returns to normal position. The driving disk is of metal and is mounted on the rear end of the propeller-shaft. The driven disk, although also made of metal, is faced with a renewable fiber or millboard rim around its outer edge. It is slidably mounted on the axle jack-shaft. To obtain the different car speeds, the driven disk is slid across the face of the driving disk, the relation of its point of contact to the center point of the driving disk determining the car's speed.



In this new car, which revives the principle of the friction drive, gear-changing is noiseless at all speeds

Know Your Own Car

Its identification can now be made absolutely sure

AUTOMOBILES valued at more than ten million dollars were stolen in New York state alone in the year 1919! This hardly seems possible, yet facts from the office of the New York Secretary of State confirm it.

It is now possible for an automobile thief, having removed the license-plates and changed the motor number and other identifying marks, to appear at the automobile bureau and, by filing an application carrying the changed motor number, to obtain new license-plates on payment of the fee.

To make it impossible to secure a license on a stolen automobile, Frank Wenzel, in charge of the automobile bureau at Albany, New York, has perfected a device to be attached to the steering-wheel of each motor vehicle operated on the highways and so placed on the vehicle as to be easily seen by any traffic officer or patrolman. This device is not intended to prevent theft, but to prevent the registration or licensing of the stolen car. This end is accomplished by reason of the fact that it is not possible to operate a motor vehicle in any state without license-plates as evidence of proper registration. Therefore, if the stolen car cannot be registered through the use of the device, it cannot be operated over the highways and there is no incentive for any one to steal it, since its unauthorized possession will afford no financial reward.

The device consists of two metal clamps, so made that they can be fastened around the rim of the steering-wheel, and held in place by screws through the rim. An immutable substance, plastic in nature, is applied in the form of a tape between the two ends of the clamps. In this material are stamped the engine number and the state seal on the upper surface and a secret key number on the under side. This key number corresponds to files kept in the registration office, where a complete description of the vehicle is on file. When a thief attempts to steal a car carrying this device, he must not only embed a new engine or car number and state seal in a substitute element, but he must be wise enough to substitute a code number corresponding with the secret key number on the bottom of the unchangeable strip of metal. This is, of course, very unlikely to happen. The thief's troubles are further aggravated by reason of the fact that any attempt to change the original number of the top of the strip results in the destruction of the chemical element used.

In the new device engine number and state seal are embedded in the upper surface, while a secret key number corresponds to a complete description at the registration office

The device may be applied to any type of steering-wheel and in no way interferes with the operation of the car. Mr. Wenzel has also developed a machine for embedding the identifying data without removing the steering-wheel from the car. This consists of a framework with three arms, and calibrating and number-cutting appliances to hold any size of wheel and apply the numbers at the same time.

The use of such a machine would become necessary if Mr. Wenzel's plan were adopted, for every vehicle on the road would have to have the identifying date or make its owner subject to arrest. If the same kind of identification were not adopted by other states, a vehicle without it when coming into New York would have to stop and have the data applied before proceeding. This would be entirely possible, for the machine could apply the data in less than twenty minutes.

The inventor estimates the cost of application of the device at not more than one dollar and a half.

An Automobile Light with Four Ranges

WHEREAS the average automobile light, when dimmed, does not give sufficient light for driving, here is a new lamp that meets all the driving requirements without dimming. This is accomplished by using two reflectors instead of one in each lamp-case.

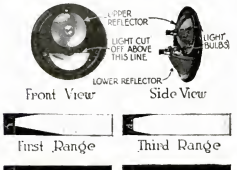
Both reflectors are fastened to the lamp-cover plate, which may be fitted to any make of lamp after the original single reflector has been removed. The reflectors are placed one above the other. The bulb in the upper reflector is visible, but that in the lower one is hidden by the cover plate. This plate not only hides the bulb, but cuts off the light horizontally, so that glare cannot possibly reach the eye.

The first range of light is secured from the upper reflector, and consists of a conical beam of light that lights the road ahead for five hundred feet. This is for country driving.

The second range is that of the lower reflector. It is used for city driving or when passing other cars on country roads. It meets all traffic regulations in cities and throws a beam one hundred and seventy-five feet ahead without rising above a height of forty-two inches, as required by law.

The third range is used when an especially powerful ray is required, and then both upper and lower lamps are lit.

The fourth range is that of the lower reflector, with the lamp dimmed by resistance. This range is for use in parking, and consumes less than two amperes of current.

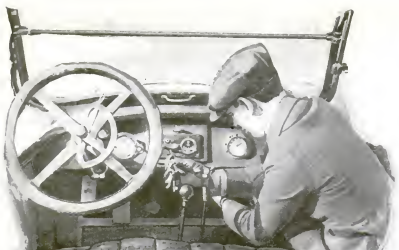


The first range lights the road for 500 feet, the second 175 feet; the third gives a very bright beam, the fourth a dim light

This new glareless headlight throws a beam so arranged that it will not blind other drivers

How Inventors Foil

Prevent the theft of your car clever devices pictured and

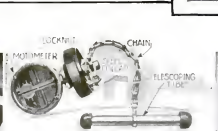


© Underwood & Underwood

The clever automobile thief generally carries a ring full of master skeleton keys for picking all types of the common ignition-switch lock. Although almost every make of car is supplied with a patent lock, it is the thief's first and best bet

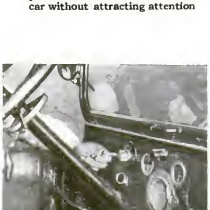
One man actually carries a dummy around with him and props it up to scare off the thieves. Some day he will find both the car and the lady gone

A simple device for thwarting the thief. When locked in place, this sharp-pointed instrument makes it almost impossible to drive or tow the car without attracting attention



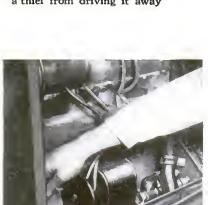
Petty thieves who make a practice of stealing motometers from radiator caps will have to turn their attention to some other more easily removable accessory if the motometer is protected by the new device shown above

Still another method, which is crude yet effective. It is accomplished by chaining and locking the steering knuckle and drag link of a motor-truck to prevent a thief from driving it away



The ignition-switch lock is perhaps the most common of all automobile-theft preventives since it is usually furnished with the car as purchased. However, almost any key that will open the lock makes it ineffective

The driver carries this removable gear-shift lever with him when he leaves the car. When the real lever is removed, a fake one is inserted in its place



Grounding the magneto by disconnecting one of the spark distributor wires, makes the engine inoperative, but does not prevent the car from being towed and steered. Ordinarily the thief easily finds a disconnected wire

Automobile Thieves

by adopting one of the many described on these two pages

© Underwood & Underwood

While most people who lock the doors of their closed cars think they are then entirely safe, this shows how the ingenious thief may cut a hole in the glass panel. Then unlocking the door and starting the car are easy

The car once stolen and taken to a garage or an unfrequented road, it is easy for the thief to remove the identifying engine number

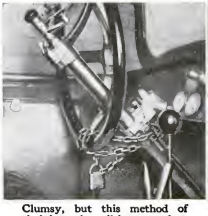
© Underwood & Underwood

A rod, hinged to the front seat riser and locked around the gearshift lever, prevents gears from being shifted. The rod is swung out of the way when not in use

Once you have taken out the inside distributor arm and put it in your pocket, it is impossible for any one else to start the engine until the arm is put back or a duplicate inserted

© Underwood & Underwood

Spectacular but hardly practicable is this electrically operated ankle vise to grab the thief when he presses the starter pedal in attempting to get the engine started



Clumsy, but this method of chaining the tilting steering-wheel to the post so that the car cannot be guided from the driver's seat, even if towed, makes the thief think twice

An unusual method is to place a special valve in the gasoline line near the tank to shut off fuel, although enough remains in the carburetor or vacuum tank to run the car a short distance

© Underwood & Underwood

Built into the car at the factory, this out-of-the-way lock prevents the gears from being shifted out of neutral, so that the engine, even if made to run, cannot propel the car

This contrivance for keeping the driver cool literally scoops up fresh air and throws it at his feet

Cool Breezes for the Driver

EVEN with the wind-shield open, on a hot day that portion of the automobile driver's compartment between the floorboards and the cowl gets little, if any, ventilation. On long drives this pocketed air is heated by close proximity to the engine and causes great discomfort to the driver.

This inconvenience may be eliminated by the fitting of a cowl ventilator. The device consists of an adjustable baffle-plate that is inserted in the top of the cowl in front of the wind-shield. It literally scoops up fresh air and throws it at the driver's feet. When the baffle-plate is closed, the ventilator is waterproof and dustproof.

In fitting to the hole cut in the cowl, two base plates are used, one on top and one underneath the cowl metal and thus forming a clamp around the edges of the opening. The operation of the baffle-plate is controlled by a small rod with a nickel-plated knob extended through the dashboard.

Illuminating the Driver's Hand at Night

"CAUTION" in large black letters on a red background glows suddenly from the driver's side of the automobile in front. You observe due caution, and presently he swings to the left in the direction of a side street. All's well.

That caution signal was attached to the back of his hand by means of a strap that fastened across the palm; the glow was caused by a small electric flash-lamp attached to it. When the driver approached the corner that he intended to turn, he pressed a push-button on the battery-box, thus turning on the light. It is almost impossible to see a driver's extended hand at night, and as a result many accidents have occurred.

This new caution signal, which was invented by Wesley Kuhlmann, of Guttenberg, New Jersey, does not hamper the driver in any way. He is well able to handle the wheel.

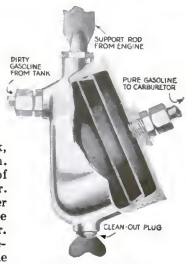
For night driving there is now an illuminated caution signal that the driver of an automobile wears on the back of his hand

Clean Gasoline in the Carburetor

GASOLINE fuel accumulates water, dirt, and other insoluble products. The dirt and water are not separated until they reach the needle-valve of the carburetor.

It was to overcome such trouble that a Buffalo concern perfected a combination gasoline purifier placed in the gasoline line at the engine. It removes all impurities just before the fuel enters the carburetor. The purifier can be applied to any type of gasoline engine. It consists of a bowl-like chamber in which the fuel passes successively through three screens of sixty-mesh wire screening, silk, and chamois in the order given. Thus the gasoline is freed of all impurities, including water.

The removal of the water also prevents freezing of the gasoline line in the winter. The use of the purifier also reduces repairs, in that when the engine operates spasmodically or unevenly because of dirt getting under the needle-valve, additional strains are set up.



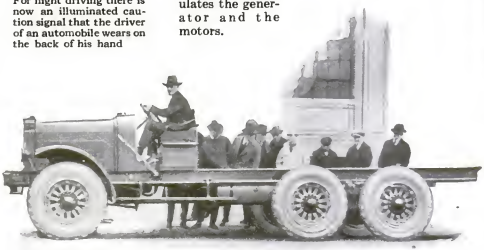
A combination gasoline purifier that removes impurities in the fuel just before it enters the carburetor

A Gasoline-Electric Motor-Truck

MANY unusual and almost revolutionary ideas have been incorporated in this six-wheeled gasoline-electric motor-truck perfected by E. W. Weaver and T. S. Kemble, two Cleveland automotive engineers. Its designers claim it has successfully passed the most rigid tests and showed a 33-per-cent increase in fuel mileage over the conventional five-ton gasoline-consuming truck.

Four electric motors drive the four rear wheels, each independent of the other. Each motor is pivoted on a dead axle and is linked to the frame after the manner of the street-car.

Tests are said to show that this truck, carrying five tons, travels at thirty miles an hour on level roads, or climbs a 45-per-cent grade at five miles an hour. This variance is said to be obtained through a controller that regulates the generator and the motors.



In this six-wheeled gasoline-electric motor-truck, each of the four rear wheels is driven by an electric motor

Repair Your Trucks on the Unit Plan

Thus you can easily save thousands of dollars a year

By Joseph Brinker

BIG Bill Butler was the maintenance boss of a fleet of fifty motor-trucks operated by a haulage company in one of our big cities. The day Big Bill was called into the general manager's office to give an account of his year's stewardship of the fleet of trucks worth $300,000, I happened to be present.

"Well, boss, the biggest thing we have done this year has been the introduction of the unit repair system. This system alone has saved us $31,625 in the cost of our truck repairs and maintenance."

"But how?" I broke in.

"It's this way," explained Bill. "Last year the average time lost on a truck, in overhauling and running repairs, was approximately thirty-nine days, divided into twenty-four days for overhauling and fifteen days for slight repairs from time to time. By the unit repair system, the number of idle days has been reduced from thirty-nine to ten days a year. The ten days of lost time are consumed in replacing defective truck parts, minor running repairs, tire changes, and a general tightening up of the truck.

"The unit truck-repair system is a simple one in which the repair work is done on units, such as the engine, clutch, gearset, and rear axle, instead of on the vehicle as a whole. Complete units are always kept on hand, ready to be installed in any truck the moment it is brought into the shop with any of these units needing extensive repairs. The old or damaged unit can be removed from the chassis and the new one installed in a fraction of the time it would take to make the repairs on the damaged unit while it remained in place on the truck itself. This means a great saving in the time the truck is out of service for repairs; for practically any, or even all, of the units can be removed and others installed in from four hours to two days.

"Of course, this does not mean taking out parts merely to grind in the valves, clean the spark-plugs, adjust the timing system, or regulate the carburetor. Referring to the engine, it concerns the replacement of the main engine bearings, wrist-pin bearings, and the repair of the lubrication system."

The general manager opened one

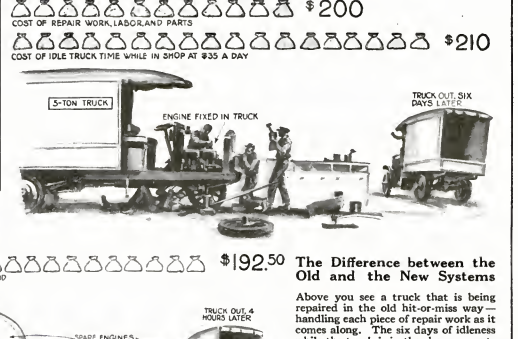
What the Unit Plan Is

Suppose you own fifty trucks. If you are making repairs on the old plan of overhauling once a year and of handling emergencies as they arise, the number of idle days for each truck is something like forty annually, a yearly maintenance cost of nearly $900 for each truck.

This has been reduced by one fleet-owner to $225. How? By the unit plan.

The idea is to have on hand a number of truck units—engine, clutch, gearset, and rear axle. In the case of the fleet mentioned, the forty days formerly lost annually has been reduced to ten.

Of course, this system of unit repairing presupposes the use of one make of truck, or at least of trucks using standardized units.



The Difference between the Old and the New Systems

Above you see a truck that is being repaired in the old hit-or-miss way—handling each piece of repair work as it comes along. The six days of idleness while the truck is in the shop amounts in money to $210, and the repairs cost $200.

Contrast this with the truck in the lower picture. By having the unit all ready to take the place of the broken one, the saving in money amounts to $192.50, and the truck is out of the shop in four hours instead of six days

of the large ledgers on his desk and read:

"It is not so much the cost of repairs that eat into our profits as it is the possible profits that we could earn while the truck is out of service undergoing repairs. An idle truck is a very expensive piece of machinery. The possible earnings that might be made by the truck were it fit for service on the road are often greater than the actual cost of the repair work, and amount to alarming proportions as soon as the size of the fleet grows to twenty-five or fifty trucks.

Are the Bearings Burned Out?

"For example, let us take a five-ton truck that is brought into the shop with burned-out bearings due to a lack of lubricating oil or to a failure of the lubrication system to function properly. If no scored cylinders or pistons resulted from the lack of lubrication and only new bearings had to be fitted, it would take two men approximately six days to remove the engine from the frame, take it apart, replace the burned bearings with new ones, put back the engine in the frame, and run the engine in before sending the truck out for road work. A complete renewal of the bearings would cost in the neighborhood of $50 and the labor about $150, making the entire job cost about $200.

"If the truck with its body were kept in the shop while the engine was being repaired, it would be out of service for six days. Since a five-ton truck is worth $35 a day, this would mean a loss of $210 for the cost of the idle truck time. This is in excess of the actual cost of labor and materials on the repair work.

"By the unit system of repair method, the complete engine may be removed at a cost of $12 within four hours, and the truck sent out ready to work, with a delay of but four hours. At the truck value of $35 a day, the four-hour lay-up for the transference of the two engines would be worth only $17.50, resulting in a net saving of idle truck time of $192.50, as compared with the usual method of repair by which the truck is kept in the shop until the engine originally damaged is repaired and replaced."

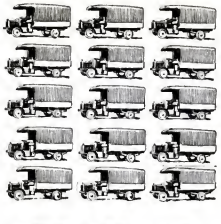
Here Big Bill broke in to say:

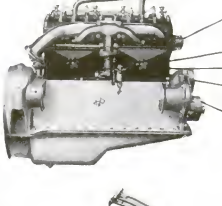
"But the saving in idle truck time is not the only advantage of the unit repair system. It has helped me to reduce the actual cost of the repair work and to keep my shop force fairly constant. As long as the trucks are out on the road, working, the repair work on the units in the shop may be done on a regular routine and without alternate rush and slack periods.

"The number of units to be kept on hand depends to a large extent on the degree of standardization of the truck fleet itself or the number of different makes or models.

"If two or three different makes of five-ton trucks are employed, as well as two or three different makes of smaller trucks,

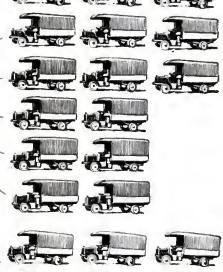
One rear axle in perfect condition will take care of fifteen trucks

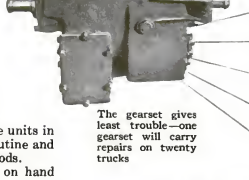




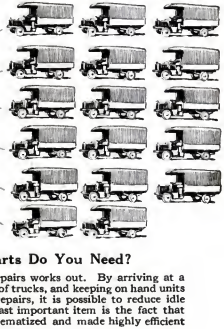
Engine trouble is more common—one engine for every ten trucks is about right

It has been estimated that one spare clutch takes care of some fifteen motor-trucks





The gearset gives least trouble—one gearset will carry repairs on twenty trucks



How Many Spare Parts Do You Need?

Here is how the unit plan of truck repairs works out. By arriving at a system of averages for a given number of trucks, and keeping on hand units ready to place in the truck needing repairs, it is possible to reduce idle truck time to a minimum. Not the least important item is the fact that the work of special mechanics is systematized and made highly efficient

it is obvious that a large number of spare units must be kept on hand to supply the different makes. But in our case, since we use only five-ton trucks of one make, the engine, clutch, gearset, rear axle, etc., for each truck are all alike. By this standardization of the fleet unit, we have to carry only three complete engines, three clutches, three gearsets, and three rear axles for our fifty trucks; and this number of units would probably be enough for twenty-five more trucks.

"The use of the unit repair system does not make it possible to reduce the quantity of individual small parts that must be kept on hand. These are necessary for emergency repairs, or when it is necessary to quickly put the damaged units in first-class shape for insertion in some other chassis.

Some of the Advantages

"Due to the unit repair system of truck maintenance, it is possible for us to adhere to a definite schedule regarding the time of replacing units in the various trucks and at the same time to have complete units on hand in order to anticipate emergencies. This system also serves to reduce the number of mechanics required, because of the steadiness of the repair work when done upon a schedule basis. Six mechanics, not including the foreman and a tester, are all that are needed to maintain our fleet of fifty trucks. Two of the men are used for inspection and rear axle work, two for engine work only, one for gearset work, and one for general work in the blacksmith shop.

"Under the former system of annual overhaul, we had to have at least fourteen men properly to maintain the trucks, in comparison with the six mechanics now required, working under the unit repair system. Under the old system men working on trucks in their annual overhaul were continually interrupted in their work by having to carry out emergency repairs."

"The principles of the unit repair system are the same the country over," interrupted the general manager, "although it is difficult to set any fixed rule to determine the number of spare units required for any fleet until a study is made of the particular work which that fleet has to perform.

"However, in some cases where assembled trucks are used, it is often possible to reduce the number of units necessary by selecting trucks of different makes that are equipped with the same make and size of component parts, such as the engine, clutch, gearset, and rear axle. For example, one make of truck of two tons capacity, designed to run at high speed, may be fitted with the same make and size of engine as used in a four-tonner designed to run at a lower speed. Thus one spare engine would serve as a service unit for these two trucks of different capacities.

"In our particular case, with three spare units of engine, clutch, gearset, and rear axle for a fleet of fifty trucks, we carry one of each of these units to approximately seventeen trucks.

How Many Parts to Carry

"For example, a fleet of 700 one-ton trucks employs one spare engine and one rear axle for every ten trucks. By the unit repair system 50 per cent of the time formerly spent for maintenance has been saved. The complete disassembling and reassembling of units that have already been repaired require from seven to eight days, including a painting of the body, as compared with from sixteen to eighteen days of individual repairing.

"With the 700 trucks, all of the same make and size, my friend has been able to carry the unit repair system one step further, namely, in carrying out the repair work on each particular unit. The saving of time by this system has been nearly 40 hours on each power plant overhaul. By specializing repairs on each unit the overhauling and assembling of an engine takes but 8½ hours. This time compares with 3 days under the ordinary system of placing the responsibility of these operations in the hands of more than one special group of men.

Write to Us About Your Motor Troubles

The Popular Science Monthly invites you to send your automobile problems to the Automobile Editor. He can tell you anything you want to know about a car, and he is here to help you

Broken Spark-Plug Wires

Q.—How can I prevent spark-plug wires from breaking at the point where they are bent around to hold under the terminal nut of the center electrode of the spark-plug?—L. A. H., Brooklyn, N. Y.

A.—When placing a wire terminal under a terminal nut such as is used on a spark-plug, be sure to twist or turn the wire in the same direction as the nut must be turned to tighten it up.

Dim Lights on Fords

Q.—Please explain why the lights on a Ford car appear to burn brighter when the engine is speeded up or the speed of the car is increased.—X. D., Newark, N. J.

A.—Unless some form of regulator is employed, the Ford lights do burn brighter when the engine is speeded up because the current is secured from the fly-wheel generator and varies with the speed of the engine.

Horsepower of Truck-Engines

Q.—Please explain how it is possible for heavy motor-trucks fitted with engines of no greater horsepower than some passenger-cars, to move heavy loads of from five to seven and a half tons.—H. F., Fort Worth, Tex.

A.—The engines of both passenger-cars and trucks perform work when they cause the vehicles to move. Work may be defined as force multiplied by space, and power as the rate of work. Power exerted for a certain time produces work. The unit of work is the foot pound, or the amount of work done in overcoming a pressure or weight equal to one pound through one foot of space. The most common unit of power is the horsepower, which is equivalent to 33,000 foot pounds a minute. In the passenger-car, the power of any given engine moves a small weight very quickly, while in the motor-truck, through a system of gearing, the power of the same engine is utilized to move a larger weight more slowly, the amount of work done being the same in both cases.

Causes of Engine Heating

Q.—What are the most common causes of automobile-engine overheating?—A. X., Paterson, N. J.

A.—The most common causes of engine overheating in the usual order of their importance are a loose fan belt; inadequate water supply in the cooling system, or a leaky radiator; clogged water jackets or hose connections; insufficient oil or old oil; incorrect spark advance and carbon in the cylinders.

Detecting Binding Brakes

Q.—If the engine seems to lack power or the car does not pick up speed and the trouble is diagnosed as slightly binding brakes, what is the simplest method to discover if this is the real trouble?—O. B., Atlanta, Ga.

A.—Aside from the inspection of the brakes while another person operates the pedal and lever, one of the easiest methods is to throw out the clutch and let the car coast down a hill. If the brakes are free, it will coast easily and pick up speed. If the brakes are binding slightly, they will tend to hold the car back and reduce its speed.

Horsepower-Weight Ratios

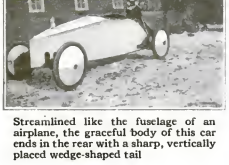
Q.—Is there a fixed ratio between engine horsepower and weight of the passenger automobile and motor-truck, and if so, what are the most usual ratios for the two types of vehicles?—J. S., Los Angeles, Cal.

A.—There are no definite fixed ratios between horsepower and weight, these varying according to the design of the car and the purposes for which it is intended. Some speedy passenger-cars have 1 hp. each 50 or 100 lbs. of weight. Others have 1 hp. each 150 lbs. weight, and the ratio increases up to 1 hp. each 300 or 400 lbs. of weight in slower-speed trucks of large capacity.

Have You a Propeller-Driven Cycle-Car?

Below is given a detailed description of how to build one

By Edward M. Folkerts



Streamlined like the fuselage of an airplane, the graceful body of this car ends in the rear with a sharp, vertically placed wedge-shaped tail

THE pictures shown are of an aerial-propeller-driven cycle-car that can be built by the amateur.

The framework of the body is of white pine covered with 28-gage galvanized sheet iron. The curved side pieces must be soaked in water before they can be bent into the right shape.

The floorboards are of ½-in. soft pine, nailed to the bottom of the cross cleats. Place two or three extra-strong cross cleats underneath the floorboards. When the floorboards have been securely nailed in place, strips of heavy sheet metal (about 20 gage) are bent in the middle to form a right angle. One part of each strip is nailed directly under a cross cleat, and the other part projects upward so that the uprights of the framework may be nailed to them. These metal strips should be about the same width as the cleats above them and 6 or 7 in. long.

Uprights and Struts

When the bottom is complete, the uprights are nailed to the projecting strips of sheet metal. The length of these uprights is most easily determined after they are put in place, so it is better to leave them slightly longer than necessary and they may be cut the required length when the curved strut is nailed across the top. This strut must be steamed or soaked in water.

It is first fastened into place at the rear and is nailed to the uprights in succession from the rear to the front. Board No. 3, Fig. 2, is about 6 in. wide, so that a vertical slot may be cut in it for the front axle. A slot must also be made for the tie-rod. Board No. 4, Fig. 2, is 7 in. wide and has a similar slot for the rear axle, but is a trifle wider, since the rear axle has a larger diameter. The uprights numbered 2 must be of extra strong wood, as the channel-iron wishbones that hold the axles in place are fastened to these.

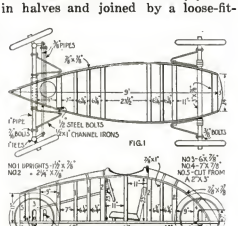
Piece No. 5 is cut from 2 in. by 3 in. stock.

After all the uprights and the two curved struts across the top have been put in place, two narrow triangular strips of white pine are nailed on top of the struts along their full length. Cross pieces are now put through the upper side of the framework. These need not be wider than 1½ in. and to these the boards in the shape of a segment of a circle, forming the curved shape of the top side of the body, are nailed. A rounding piece is fastened to the rear of the bottom, and the corners of the opening in the top are filled in.

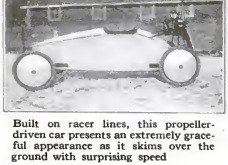
In front the body of the car also ends in a wedge, but it is slightly convex and is placed horizontally. The air pressure increases the stability

The running gear consists of four motorcycle wheels. Gas-pipes are used for axles and steering apparatus connections. A 1¼-in. pipe is used for the rear axle and it is held in place by the two wishbone-shaped channel irons.

The front axle is of 1-in. pipe cut in halves and joined by a loose-fitting coupling. The coupling allows either front wheel to go above or below the level of its mate without any tendency of the axle and wishbones to bind. A 1-in. tee is screwed on each end of the axle and through these tees ¾-in. nipples are put. (The tees are filled with Babbitt-metal to form a smooth bearing.) To the lower end of the nipple through the tee is attached an elbow into which is screwed another nipple, which serves as a spindle for the front wheel. To the upper end of the nipple through the tee is attached another elbow facing to the rear. In this elbow is attached a ½-in. pipe by the use of a bushing. The ½-in. pipe serves as the arm or lever to which the tie-rod is attached. A set of gears from a discarded lawn-mower will serve for the steering apparatus.



There is nothing complicated in the construction of this car. The two diagrams give all the dimensions necessary to guide the amateur builder



Built on racer lines, this propeller-driven car presents an extremely graceful appearance as it skims over the ground with surprising speed

Power and Propeller

The power is furnished by a twin-cylinder motorcycle engine supported at the rear end of the body on four ⅜-in. pipes. The gasoline tank is placed in the front end of the body and the fuel is forced to the carburetor by air pressure. The propeller is attached to the sprocket wheel of the motor by bolts. First a heavy metal washer about 5 in. in diameter is placed against the outer side of the sprocket wheel and holes are drilled through the washer for the propeller bolts between the sprocket teeth. The heads of the bolts are then hooked over the edges of the sprocket teeth and the propeller is afterward clamped tightly against the washer.

A propeller can be procured from an airplane factory or can be carved from 4 by 6 in. stock. Brakes and lights are left to the discretion of the builder.

A cycle-car of this type will carry two passengers at a maximum speed of 30 miles an hour at about 35 miles on a gallon of fuel unless road conditions are exceptionally bad.

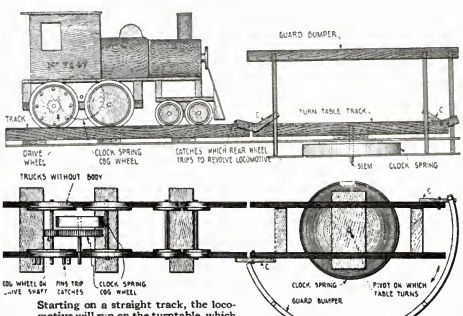
Making a Turntable for a Toy Locomotive

By F. E. Brimmer

I CONSTRUCTED both the locomotive and turntable of light wood. The motive power for the locomotive was a clock-spring from an old eight-day clock. (See drawings for position of spring.)

The power to revolve the automatic turntable was a similar spring. When the rear wheel of the locomotive goes upon the turntable, it trips catch *C*, which permits the table to revolve a half turn, when it is caught in place by the opposite catch. The purpose of the guard bumper is to stop the locomotive when it gets on to the table and to hold it stationary until the table has revolved. The front of the locomotive rubs against the guard bumper always. When the turntable catches on the half turn, the engine is in position to dash out.

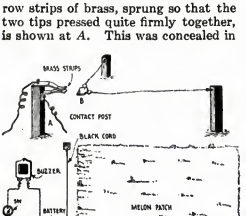
The diameter of the drive-wheels I made was 5 in. The track was 6 in. wide. The diameter of the wooden cylinder imitating the boiler was 4 in. The guard bumper was cut out by compass saw on a radius equal to half the length of the turntable.



Starting on a straight track, the locomotive will run on the turntable, which will automatically revolve, stopping after a half turn and releasing the engine, which returns to position

Silently Guarding the Melon Patch

BELOW is shown the details of an alarm that was rigged up and made ready in an evening. The contact post, consisting of a small stick of wood to which were attached two narrow strips of brass, sprung so that the two tips pressed quite firmly together, is shown at *A*. This was concealed in a small clump of uncut weeds. A small piece of fiber was slipped between the two tongues of the post to keep the circuit broken. From the two sides of the washer *B* strong fine black cord was stretched across two sides of the patch and secured to two other small posts, also concealed.



Trespassers cannot see the black string in the dark, and by running against it they release the alarm

Engaged by the feet and legs of the trespasser, the fiber clip was jerked from between the brass tongues of the contact post and the circuit was made, sounding a buzzer in the bedroom of the gardener. The two wires of a fence were used for part of the circuit.

Here's an Adjustable T-Square for Draftsmen

A SOLID T-square can be converted into an adjustable one, as the accompanying illustration shows.

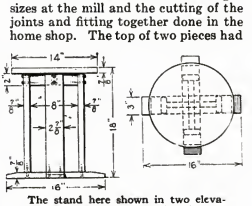
The wood screws that secure the straight edge to the head should be removed and a good size flat-head screw with a knurled thumb-nut substituted. A piece of steel shaped as shown has an end fastened with small wood screws to the straight edge and the other end slides through a clamp fastened to the head.

Draftsmen will find an adjustable T-square extremely useful

An Ornamental and Useful Flower-Stand

THE flower-stand shown here takes very little work and material.

The lumber can be cut to the right sizes at the mill and the cutting of the joints and fitting together done in the home shop. The top of two pieces had best be glued together, with three dowels in the glue joint for strength.



The stand here shown in two elevations has a round top, but it may also be made with a square top

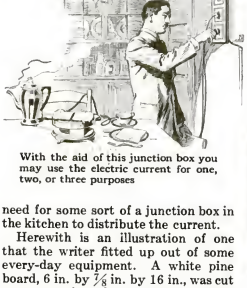
Cut the legs to the sizes shown in the drawing and square the ends carefully. The upper cross pieces and the base pieces are fitted with a cross lap joint. Fasten the base together with two ¾-in. flat-head screws. Sandpaper all the pieces thoroughly and assemble.

The top is fastened in place with four ¾ by 2 in. pieces of brass about 18 gage. One end of each brass piece is fastened to the upper cross piece and the other end is screwed to the top. If the amateur carpenter desires, he may make the top square.

The finish should be a good oil stain. Conclude the finishing process with two coats of wax.—M. TOCABEN.

Provide a Junction Box for Electric Utensils

TODAY it is quite the usual thing to find the housewife using an electric toaster, an electric coffee percolator, and even an electric motor-driven egg-beater. Necessarily this makes a need for some sort of a junction box in the kitchen to distribute the current.



With the aid of this junction box you may use the electric current for one, two, or three purposes

Herewith is an illustration of one that the writer fitted up out of some every-day equipment. A white pine board, 6 in. by $\frac{7}{8}$ in. by 16 in., was cut out to take three standard base receptacles with closing covers. These were mounted in place without the pressed-steel wall-box and the three wired in parallel. The whole was mounted on two brackets arranged to swing from the wall as shown.

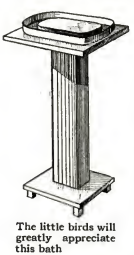
Counting labor and time, it represents a cost of $7.65 and is well worth every penny.

The leading wires not shown were connected by a heavy flexible cord with a circuit in the cellar.—W. B. BENNETT.

Making a Bird-Bath from a Roasting-Pan

USING such materials as he found in cellar and attic, a young student of landscape gardening made the bird-bath pictured below.

The upper and lower platforms and the square post that supports the upper one were made from boards taken from a discarded wooden bed. The four small posts at the foot are knobs from the old four-poster. The bath itself is the lower half of an oval iron roasting-pan, of the type having the center of the bottom raised and surrounded by a trough for the drippings. The use of a pan of this type provides water of two depths, shallow in the center and deep around the rim. When finished, the entire outfit, bath and support, was given several coats of white paint.

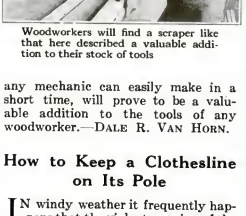


The little birds will greatly appreciate this bath

A Hardwood Scraper from an Old Plane Bit

WHEN you are in need of a good scraper for particular jobs, make one like the one shown in the illustration. The bit, ground to a thick bevel, is fastened by means of a screw through a small piece of sheet iron to a handle fashioned from 2-in. material.

This scraper, instead of merely scraping the surface, takes off a thin shaving, and there is no danger of running too deep. This tool, which any mechanic can easily make in a short time, will prove to be a valuable addition to the tools of any woodworker.—DALE R. VAN HORN.



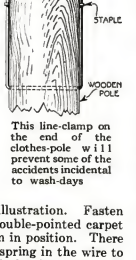
Woodworkers will find a scraper like that here described a valuable addition to their stock of tools

How to Keep a Clothesline on Its Pole

IN windy weather it frequently happens that the violent swaying of the heavy load on the clothesline causes it to slip from the notch in the supporting pole. The result is usually disastrous and part of the washing has to be done over.

Such accidents may be prevented by providing the poles with supporting hooks.

Bore a hole with a $\frac{1}{8}$-in. drill diagonally through the pole, about 2 in. from the top, insert a wire in the hole and bend the two ends as shown in the illustration. Fasten the wires with double-pointed carpet tacks to lock them in position. There should be enough spring in the wire to firmly hold the clothesline, which is slipped between the two curved ends of the clamp.—LEO KOENIG.



This line-clamp on the end of the clothes-pole will prevent some of the accidents incidental to wash-days

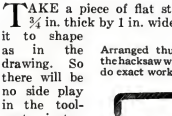
Made of Cardboard Is This Brush and Pencil Rack

AN excellent brush and pencil rack is made with corrugated cardboard mounted or glued on to a block of wood or cardboard box. The cardboard is cut the desired length and width and a second one the same size and shape is glued on to the first, but with the grooves running crosswise, thereby preventing the sides from warping. The pencils, brushes, etc., being put along the grooves, cannot roll off, and brushes still wet with color will not smear the table, since they are raised above it.—A. SCHAAL.

Draftsmen who believe in neatness will heartily approve of this rack for brushes and pencils

Learning the Morse Code with a Spark-Coil

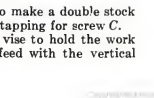
PROVIDED you have a Ford spark-coil and a battery, you can improvise an apparatus that will enable your boy to study the Morse code to his heart's content. The illustration clearly explains the arrangement and wiring. One of the wires is attached to the end contact of the coil and the battery. The other wire is attached to one of the little screws that hold the vibrating platinum blade. Both wires are attached to the key as shown.—PAUL J. SCHMIDT.



Your boy will be delighted to learn the Morse code

To Transform a Shaper into a Hacksaw

TAKE a piece of flat stock about $\frac{3}{4}$ in. thick by 1 in. wide and bend it to shape as in the drawing. So there will be no side play in the tool-post, rivet a strip of steel to part *A*.



Arranged thus, the hacksaw will do exact work

Bend end *B* to make a double stock for drilling and tapping for screw *C*.

Use a shaper vise to hold the work to be cut and feed with the vertical handle *D*.

"—and Tomorrow We'll Fish the Flambeau"

"I've a hunch there's good fishin' up in that country, Fat. Up beyond the Reservation, where it ain't all fished out."

"I'm with you, Sam. We couldn't get up there last year—wasn't enough road for the car—but with the little old Harley-Davidson we can make it easy."

"You said something, Fat. It's not the motorcycle's fault you never catch any fish. But with your Harley-Davidson and my fishin' skill we've got a combination that's a darb. I admit it!"

Fifty miles for a dollar—gas, oil and tires—is mighty cheap transportation. Ask any Harley-Davidson dealer for demonstration. Or write to us for literature.

HARLEY-DAVIDSON MOTOR CO., MILWAUKEE, WIS.

Harley-Davidson
"World's Champion"

Amuse the Children with the Balancing Acrobat

ILLUSTRATED here is a toy that performs tricks a real acrobat is unable to do. It can hang by its toes, or even by one toe, with the body hanging in space, without support. If the arms are properly adjusted, it will stand on one or both arms with the body at any angle desired.

Showing the different parts of this amusing toy

The figure is carved from one solid piece of wood 3 in. long and 1 in. wide and ¾ in. thick. By whittling, this block of wood is fashioned to resemble the form of a human body. At one end a long V-shaped cut is made to form the legs of the acrobat. A pair of arms, also rudely fashioned, are then supplied. They are made of wood ¼ in. thick, ¾ in. wide, and 2 in. long. They are drilled at the shoulder end, to fit tightly on a pin connecting them with the body. At the ends of the arms notches are cut to support the balancing-pole.

Here the little man is standing erect

The arms are then attached to the body of the toy man.

The balancing-pole is provided with two wooden balls about 1 in. in diameter. The pole should be ¼ in. thick and 14 in. long. It should have a permanent bend in it, the center of which should be 3 in. from the line passing through its ends. This pole is fastened to the hands of the acrobat by small nails. A pedestal is made from a stick 10 in. long and 1 in. in diameter, with a 2-in. disk on top and a 5-in. disk at the bottom. The acrobat can be placed on top of this pedestal in almost any imaginable position.

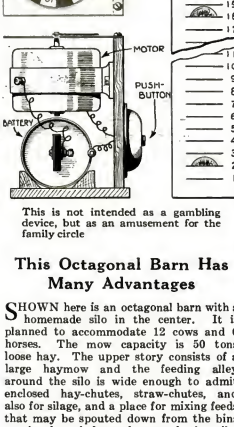
Here he seems to defy the law of gravity

An Electric Game for the Home Circle

THE little spinning pointers used in different types of games can be electrically driven as illustrated here.

A toy motor drives the pointer. The motor is placed in the way shown in the picture. Directly under it is the dry cell. Mounted at the side is the push-button. To the upright piece that holds the motor and the push-button, the dial is tacked. The shaft of the motor protrudes through the center of the dial and the little pointer may then be soldered to it. If the button is given a push, when the pressure is released, the hand will stop. Its position will always be different, thereby introducing an element of chance.

The writer has invented a game shown in the illustration. This is called the Ladder of Success. It merely consists of a cardboard strip with slots cut in it. These slots accommodate a penny. The slots are numbered 1 to 25. The players spin the motor and if the pointer stops at 3, one of the pennies is moved up three rungs of the ladder. If the pointer happens to stop on one of the shaded portions of the dial, the corresponding number of rungs or steps is sacrificed. The player who gets to the top of the ladder first, wins.—CARL ROYER.



This is not intended as a gambling device, but as an amusement for the family circle

This Octagonal Barn Has Many Advantages

SHOWN here is an octagonal barn with a homemade silo in the center. It is planned to accommodate 12 cows and 6 horses. The mow capacity is 50 tons loose hay. The upper story consists of a large haymow and the feeding alley around the silo is wide enough to admit enclosed hay-chutes, straw-chutes, and also for silage, and a place for mixing feeds that may be spouted down from the bins overhead and located around the silo.

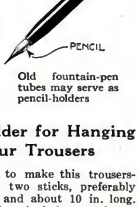
Octagonal barns are unconventional, but they offer certain advantages as here set forth

There is also a granary on the main floor of the barn that will be handy for feeding.

This barn can be arranged so as to hold 24 stalls for milch-cows. Hay is placed in the barn by driving the hay-wagon inside and hoisting hay to the mow with a hay-carrier.

How to Make Use of an Old Fountain-Pen

YOU can use old fountain-pens as pencil-holders. If it is a self-filling pen, take the rubber tubing from the barrel and also remove the part that holds the pen-point. After this is accomplished, take a piece of pencil about 3 in. long and place it in the barrel of the pen, leaving about ¾ in. projecting from the barrel.



Old fountain-pen tubes may serve as pencil-holders

This makes a neat-looking pencil and the lead is protected from being broken.—CLEM S. GREER.

Make a Holder for Hanging Up Your Trousers

IT is very easy to make this trousers-holder. Take two sticks, preferably ¾ in. by ⅞ in., and about 10 in. long. Three quarters of an inch from each end drill holes of about ⅛-in. diameter in each stick, then bore a second set about ¾ in. from the first holes. This must be done on both sticks. Then take a stout string, part

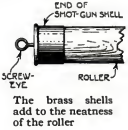
If you use this holder with regularity, your trousers will retain their form much longer

of a fishline will do, and pull through the outer holes of the two sticks. Then pull the ends through the second pair of holes and tie a knot large enough so that it will not pull through the hole. This completes the hanger.

Take the trousers by the legs, pull the two sticks apart as far as they will go, insert the ends of the legs, and pull the string on the upper stick. This will draw the two pieces together. Hang in the closet on nail or hook.—E. BADE.

Brass Shells for the Shade-Roller Ends

FITTING the ends of a homemade roller with empty shotgun shells makes them uniform, as well as giving the roller a finished appearance.



The brass shells add to the neatness of the roller

A rough stick first fitted with the cartridge ends can be smoothed down uniformly, the ends acting as a gage.—JAMES M. KANE.

Carpenters' Gages Can Be Made Cheaply

HOME workshops can be supplied with a gage that will cost nothing beyond a few minutes' work, and that will be quite as effective as one costing more.

Procure a large spool and trim a stick of hard wood till the spool will slide on it easily. Drive a small brad in one end of the stick and slip the spool on the other. A set screw can be made of a small screw-eye screwed into the spool.

This gage could be improvised very quickly

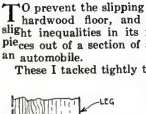
Adjustment is made by sliding the spool on the stick till it reaches the position desired, then tightening the set screw.

It will be best to file off the sharp point of the screw-eye to keep it from scarring the stick.—H. F. GRINSTEAD.

To Prevent a Stand from Slipping on Hard Wood

TO prevent the slipping of a stand on a hardwood floor, and also to adjust slight inequalities in its feet, I cut four pieces out of a section of an inner tube of an automobile.

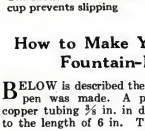
These I tacked tightly to the legs of the stand. The tight tacking produced a cup-shape formation of the rubber, the suction of which answered the purpose better than anything else I could have used. — JAMES M. KANE.



The suction of the rubber cup prevents slipping

How to Make Your Own Fountain-Pen

BELOW is described the way a fountain-pen was made. A piece of brass or copper tubing 5/8 in. in diameter was cut to the length of 6 in. The upper end of the tube was then closed with a cork. This cork should be solid and free from holes, to insure against leaking.



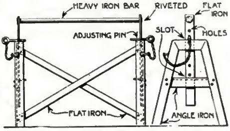
The principle of this pen is that of the most expensive fountain-pen

A shallow groove was then cut into one side of a cork, beginning at the small end and extending two thirds of the way down. This cork was inserted in the open end of the tube, having first been coated with a thin layer of mucilage.

A small hole was bored through the lower end of the tube and a common large pen bound over it, being held by small rubber bands, firmly, but not close enough to prevent the flow of ink.

An Adjustable Horse Made of Metal

THE all-metal adjustable horse shown in the illustration was introduced in one of the shipyards on the Atlantic coast to take the place of the wooden horse that had formerly been in use. Although the metal horse costs a trifle more than a wooden horse, it lasts a great deal longer, hence meaning considerable saving. It stands 3 ft. high but can be raised to 5 ft.



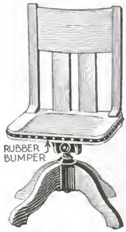
For heavy work an iron horse like that shown here will be found more lasting than a wooden trestle

Parts of the trestle braces and cross pieces are made of flat bars of iron. The supporting bar of the horse consists of a heavy iron bar with its ends riveted in the sliding supports that are adjustable by means of pins.—JOHN J. BORMIDE.

Protecting Office Furniture from Injury

GOOD office furniture and desks in the home are usually marred by pushing the chair underneath the desk, bumping the legs, scraping off the finish and chipping pieces of the wood off the edges.

This can be avoided by placing a rubber band ⅛ in. thick on the chair, as shown in the illustration, with tacks having rubber - covered heads. This protects the desk as well as the chair and will not in any way mar the chair, make it unsightly, or interfere with its usefulness. A thin piece of sheet rubber doubled over, or a small rubber tube, may be used.—H. E. MENDE.

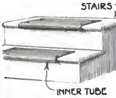


The rubber band protects the furniture

Soften Noise by Using Rubber Stair-Treads

OLD inner tubes may be utilized to advantage for making wooden stairs practically noiseless. The tubes are split open their entire length and cut into strips 18 in. long and as wide as the circumference of the tubes.

These strips are tacked on the steps in the manner shown in the illustration. One side is bent over the edge of the steps and is nailed down with wire nails.



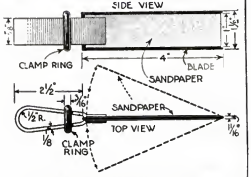
These stair-treads are made from old inner tubes

Any Draftsman Can Make This Sandpaper Block

SERVICEABLE sandpaper blocks for draftsmen may be made by following the directions here given. The drawing is self-explanatory, but it should be noted that it is best to make the clamp ring a solid piece. The writer tried first to bend up 3/16-in. wire and met with failure.

The handle is to be made of 3/4-in. by 3/4-in. strip carbon tool steel and drawn to a good springy temper. This enables the user to employ sandpaper cut 1 in. wide.

To use this device, cut a piece of the desired sandpaper 1 in. wide by 8 in. long,

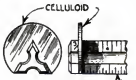


Any draftsman can make for himself one of these convenient accessories

crease it by doubling, slip it over the blade of the tool, and clamp the handle in place by driving the clamp ring over it.

Making Work Easier with a Scale-Holder

A DRAFTSMAN'S rule is triangular, having six scales, two on each side. He may be using the scale of 50 ft. to the inch, but when he lays down the rule, it will invariably tumble over on another side. When the draftsman again picks up the scale, he must turn it over, looking at the scales till the 50-ft. one is found.



This disk will keep a scale from turning

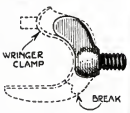
This annoyance may be overcome by placing at each end of the scale a piece of celluloid as shown in the illustration.

It can be readily seen that the scale will always roll over on the flat side. By placing this circular piece of celluloid on any one of the three sides, the desired scale can be kept in sight.—E. G. GETTINS.

To Repair the Broken Screw of a Meat-Grinder

THE family meat-grinder giving out and no thumbscrew being handy, I made one out of an old wringer clamp.

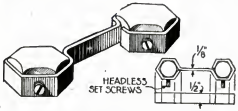
A piece of the threaded end had to be cut off to make the screw the same length as the old one. It was not necessary to cut a new thread on the screw, but I ran a tap in so as to make the screw work freely.



An emergency meat-grinder repair

Here Is One Way to Lock Hexagonal Nuts

QUICK and easy is the method for providing locking means for hexagonal nuts shown in the accompanying illustration. The job was done on the gear-box of an automobile. The plugs for the shifting

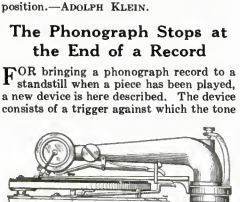


This illustrates one method of locking two hexagonal nuts, provided they are separated by a short distance only

forks were held by means of lock washers; and these washers, pressing against the soft aluminum case, caused the latter to be severely torn and damaged. I finally concluded that the plugs must be held by some means other than the lock washers. A piece of ½ in. by ⅛ in. strip steel was made red hot, and was hammered to the shape indicated, one of the plugs being used as a die while the forging was done. Two headless set screws served to hold the lock in position.—ADOLPH KLEIN.

The Phonograph Stops at the End of a Record

FOR bringing a phonograph record to a standstill when a piece has been played, a new device is here described. The device consists of a trigger against which the tone



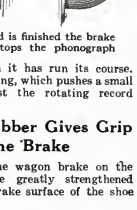
When the record is finished the brake automatically stops the phonograph

arm presses when it has run its course. This releases a spring, which pushes a small brake-shoe against the rotating record table.

Old Tire Rubber Gives Grip to the Brake

THE grip of the wagon brake on the wheel may be greatly strengthened by covering the brake surface of the shoe with a piece of old rubber tire fastened to the wood with wooden screws.

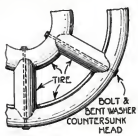
The width of the strip depends on the width of the wheel tire. An allowance should be made for a lap of 1 in. through which the screws pass. — W. H. GILES.



Nail a piece of old tire on the brake-shoe

Trunks May Safely Be Dropped on This Mat

OLD tires, too worn to be used on an automobile, will supply excellent material for making a baggage mat such as is used at the railway stations to protect baggage from injury when it is dropped on the platform from cars or trucks.



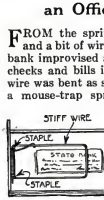
Defy baggage-smashers with a mat like this

The mat is of circular form. One tire, left complete, forms the outer circle. The inner circle is made from part of another tire. What is left of the rubber fabric is cut in pieces to form the connecting spokes.

The two rubber circles and cross pieces are bolted together as shown in the illustration. The bolts are so placed that the nuts point toward the center. The heads of the bolts are provided with bent washers so that they be flush on the outer rim.

How a Mouse-Trap Became an Office Accessory

FROM the spring of an old mouse-trap and a bit of wire the cashier of a Western bank improvised a clip for holding flat the checks and bills in the cash drawer. The wire was bent as shown in the picture with a mouse-trap spring around one of the short sides of the rectangle. Two small staples fastened the contrivance on one side of the cash-drawer compartment as shown at the left.



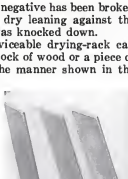
The spring presses down the wire loop

The holder or clip could be raised easily when it became necessary to add more checks to the pile.—L. M. BRIGHAM.

A Drying-Rack for Your Photographic Plates

MANY a good negative has been broken when left to dry leaning against the wall, because it was knocked down.

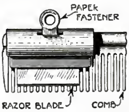
A perfectly serviceable drying-rack can be made from a block of wood or a piece of heavy board in the manner shown in the illustration. Parallel grooves of approximately the thickness of the glass plates are sawed into the wide part of the board or block to the depth of about ⅛ in. The plates are placed in these grooves and left standing with a slight slant until they are dry.


In a pinch this plate-rack will render good service

A Safety Razor and a Clip Make a Hair-Cutter

WITH a pocket comb, a safety-razor blade, and an ordinary paper-snap, which can be purchased in any 5-and-10-cent store, a practical safety razor and hair-cutter can be easily contrived.

To be used as a razor, lay the blade on the comb, so that the edge of the blade projects slightly over the edge of the comb, then make it stationary by clamping on the paper-snap.



For a haircut the razor blade should be placed as shown here

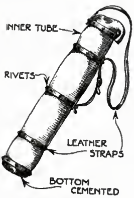
For cutting hair, place the blade slightly behind the edge of the comb, and clamp in place with the paper-snap. The blade may be adjusted to cut the hair long or short, according to the taste of the individual.

To cut the hair, operate this device as you would an ordinary comb, using two mirrors to insure accuracy and uniformity. To get the best results, wet the hair before using the cutter.—LEO D. THREW.

Keep Golf-Sticks Dry in a Rubber Bag

FROM a few feet of inner tubing in fairly good condition a golf-bag may be made which, better than a canvas or leather bag, will keep the clubs dry in any kind of weather.

The bottom of the bag may be made by cementing a round piece of rubber to the inner tube, which should be folded over the inserted bottom, and cemented to it. Instead of cement, rivets may be used.



This golf-bag will keep your clubs from warping

To stiffen the bag and hold it in shape, leather straps should be cemented or riveted on the outside, as shown in the illustration. A separate container for golf-balls may be cemented to the bag and straps for carrying the bag attached by rivets.—C. A. BLACK, JR.

Ether Is Useful for Cleaning Clothing

ETHER is very useful for removing grease spots from clothing and other textiles. For a long time it has been used in cotton and woolen mills for removing spots from new cloth.

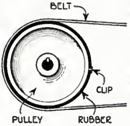
Ether can be purchased in drug-stores in half-pound cans. It is not expensive, but is very volatile. After taking the required amount from the can, the container must be tightly closed as soon as possible.

Ether is inflammable and should not be used anywhere near an open flame or open fire, nor in a closed room where the ventilation is not good. The same care should be exercised in its use as in the use of gasoline, benzine, and like products.

How to Give Your Pulley a Better Grip

SHOULD your belt slip on the pulley, you can remedy the trouble easily if you have an old automobile tire available.

The side walls of old tires are usually in good condition. If you cut them out of the casing and fit them around the pulley, it will save you a great deal of trouble and loss of power. Cut the strips of side walls so that they will fit exactly around the pulley. Apply some glue to the fabric under the rubber, also to the circumference of the wheel, and fasten the ends together by clips or by a regular belt lacing.—DANIEL COPENHAVER.

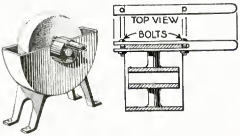


The rubber will give the pulley a firmer grip on the belt

A Grindstone Crank with Pulley Drive

A CRANK handle fitted to the pulley furnished with a belt-driven grindstone has proved very successful. The stone had been sent to a place having no available power. Instead of making an entirely new crank, a round wooden handle was sawed and bolted to the pulley rim.

The two bolts hold the handle firmly in its place and thus prevent any accidental splitting.—R. C. HITCHCOCK.



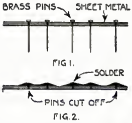
If you cannot belt your grindstone to a driveshaft pulley, turn it by hand power with this crank

Use Pins When Soldering Holes in Sheet Metal

IN soldering a sheet-iron boiler, I found that the pit holes (or rust holes) would not let the solder run over them. As I did not want to insert a patch, I inserted pins in the holes—first cleaning the surface of the metal.

Then I applied solder flux and put a bit of solder over each pinhead, lifting the iron so that a little mount of solder was formed over each pinhead.

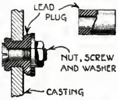
The points were clipped off and filed flush.—JAMES M. KANE.



Brass pins inserted in the holes of a leaky wash-boiler made the soldering much easier

Expanding Lead Plug for a Casting Hole

A SMALL hole in a casting, as a sand hole, can be readily closed with a piece of lead the size of a shot, calked in with a hlunt-nosed tool. A larger hole, ½ in. or more, requires a plug of such size that a successful calking joh is not practical. In the event that the casting will stand threading, a tapped plug is correct and makes a serviceable repair.



The lead bushing plugs the hole in the casting

A thin casting, especially of cast iron, cannot be tapped for a dependable thread. A repair under these circumstances is made with a round lead plug and a small screw-bolt. Drill a hole through the plug smaller than the screw-holt and drive this in. Then drive the plug in the hole after truing it up somewhat; with a drill set a washer over the screw and put on the nut. The nut can he screwed as tight as required; expand the lead and pack it solidly about the hole.—G. A. LUERS.

Bottle-Caps as a Back-Door Foot-Scraper

HERE is a scraper that will take off the worst mud from shoes. It can be made at home from bottle-caps. These metal bottle-caps, with which so many of our hottles are closed, are saved until a number of them have been collected. Then a ½-in. hoard of any convenient length and width is taken and two strips of narrow wood are screwed on each end to prevent warping.

Discarded bottle-caps made this foot-scraper

The hottle-caps are nailed to this base, using two nails for each cap. A neat appearance is given to the scraper if the caps are nailed in parallel rows.

This scraper is cleaned hy simply jarring the dirt loose.

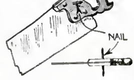
Prevent Your Saw from Slipping Away

SOMETIMES when a carpenter's saw is laid upon a roof of considerahle pitch, it has a tendency to slide off. This can he prevented hy a simple means shown in the illustration.

Bore a hole in the saw handle and drive a long wire nail through it of slightly larger diameter. It should project at least an inch on each side.

Then the head should be cut off and hoth ends of the nail filed down to a sharp point.

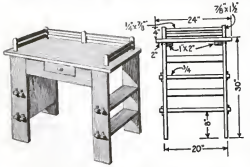
No matter which side of the saw is laid down on the roof, one end or the other of the nail will stick to the shingles and prevent the saw from slipping.—L. B. ROBBINS.



A nail will prevent the saw from slipping

A Combination Table of Simple Construction

FOR the benefit of amateur carpenters who wish to add to the furnishings of their home, directions are given here for making a useful as well as an ornamental

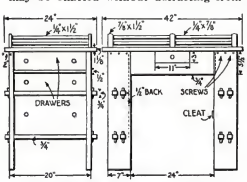


Perspective view and side view of a handsome combination table that can be made with a few tools

combination table, particularly suited for the library.

The general appearance of this table is shown in the perspective illustration and the details of its construction and all necessary measurements are given in the diagrams accompanying this article.

The choice of wood is left entirely to the amateur carpenter. It is best, however, to select strong hardwood of a color harmonizing with the color of the furniture in the room. The rail on three sides of the top may be omitted without detracting from

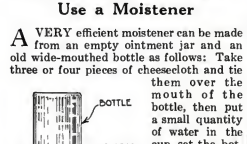


By following the design and the measurements given here with care, you will avoid disappointing errors

the appearance of the table. The small drawer directly underneath the top of the table may also be omitted, but it will be found convenient for stowing away memorandum books, paper, pens, etc., if the table is used for writing purposes.

Do Not Use Your Tongue; Use a Moistener

A VERY efficient moistener can be made from an empty ointment jar and an old wide-mouthed bottle as follows: Take three or four pieces of cheesecloth and tie them over the mouth of the bottle, then put a small quantity of water in the cup, set the bottle with cheesecloth in the water and the moistener is ready to use.



Use a moistener instead of your tongue

This will be found very effective in applying labels, stamps, etc.

How Soldiers in Texas Built an Ice-Chest

THE ice-chest shown and described here was built by the writer and his comrades while they were stationed with the army in Texas.

The front and rear sections were made, as shown in the drawing, of 2 in. by 4 in. scantling. One side was covered with

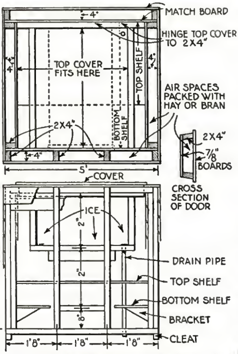
Soldiers of an American regiment stationed on the Mexican border built this refrigerator

matched bcards, the space between the 2 in. by 4 in. was packed with hay and the boards were nailed on the otber side. Cleats were run along the inside of each section about 2 in. above the bottom of the boards so that a 2-in. air space would be allowed between the eartb and the floor.

The front and rear sections were then set up, squared and levelled, and a 2 in. by 4 in. was nailed at each end, as shown in assembling plan.

Another 2 in. by 4 in. was laid between the front and rear sections to form a bottom for the sides or ends. The boards were then run up on the sides. The pockets thus made were stuffed with hay and another 2 in. by 4 in. was cut in to close it tight.

The top icing door and the front door were made as shown in the door detail, the



These diagrams show the construction of the double-walled ice-chest and its dimensions

outside board being allowed to project about 2 in. beyond the door itself on all sides except the one on which the hinges were placed.

The ice-chest described was doing duty for a troop of eighty men and was very

satisfactory in spite of the fact that it cost nothing to build except for a galvanized pan, which they had made to hold the ice. This pan rested on a board platform laid on two 2 in. by 4 in. which were nailed flush with the top of the front door. The water was carried off by means of a pipe connected with the pan.

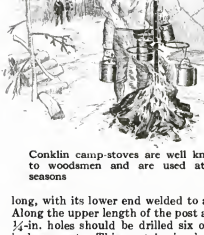
Build Your Own Camp-Stove for Your Vacation

THE camp-stove shown in the illustration was used successfully for ten years by G. W. Conklin, the maker.

It may be easily constructed by the handy man and Mr. Conklin freely gave the writer permission to tell the readers of this magazine how the stove is made.

The supporting part is a post. Working on this is a movable part that can be adjusted to a height suitable to the heat used. This part carries three lids, on which cooking may be done as on an ordinary stove, or pails may be hung to them.

The central post is an iron pipe 3 or 4 ft.



Conklin camp-stoves are well known to woodsmen and are used at all seasons

long, with its lower end welded to a point. Along the upper length of the post a row of ¼-in. holes should be drilled six or seven inches apart. This post is simply driven into the ground where the stove is to be used.

The part that works up and down on the post is a piece of pipe just large enough to slip over the post and has its upper end split into three parts. Its length before splitting should be 3 in. and the splits are made downward for 1½ in. In each of the three ears made by the splits, small holes are drilled to take the lids of the stove. Each lid is made from heavy wire to the shape shown and is attached to the ears of the movable part by being bent like an ordinary stove handle. The diameter of the griddles may be suited to the parts of the woodsman's outfit, from 6 to 10 inches being best. Wire hooks should be used to hang pots and kettles to the under side of the griddles and to the main post.

Varnish for Floors Made from Simple Ingredients

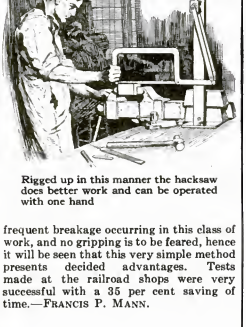
A VARNISH that is suited for hardwood floors in the house or shop, that is waterproof and has good wearing qualities, consists of the following proportions of rosin, turpentine, and linseed oil:

One pound of rosin, dissolved in 1 pt. of turpentine to which add 2 qt. of boiled linseed oil. These are mixed thoroughly and then applied evenly in the usual manner.—G. A. LUERS.

Metal-Sawing Method that Aids Efficiency

METAL sawing can be done more efficiently by supporting the saw at one end. The workman can make a longer cut than without such support, employing a long blade, with a consequent saving of time.

As the blade is now guided throughout the stroke, it is no longer subject to the



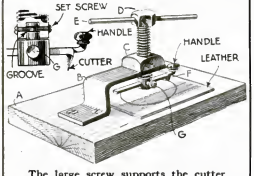
Rigged up in this manner the hacksaw does better work and can be operated with one hand

frequent breakage occurring in this class of work, and no gripping is to be feared, hence it will be seen that this very simple method presents decided advantages. Tests made at the railroad shops were very successful with a 35 per cent saving of time.—FRANCIS P. MANN.

For Cutting Circular Gaskets or Washers

HEREWITH is illustrated a machine for the cutting of circular gaskets or washers. This little device will often be found useful in a garage repair-shop, and at times will be instrumental in saving time.

It consists of a hardwood rectangular base *A* cut to such size as to accommodate



The large screw supports the cutter and regulates its tension and depth of cut

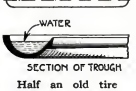
bracket *B*, to which is riveted the square nut *C*, acts as the bearing for the screw *D*. This is provided with a hole at its swiveled lower end, through which passes the cutter *F*.

The cutter is adjustable, and may be set for any size of washer; while set-screw *G* holds it firmly in position. The handle *E*, was provided to facilitate the operation of the pressure screw. The leather or felt is held with one hand, while the cutting is done with the other.—ADOLPH KLEIN.

Let Chickens Drink from a Rubber Trough

IF you have an old automobile tire that has outlived its usefulness as a tire, and you have no other more important use for it, you may transform it into a watering-trough for your chickens.

With a sharp knife cut the tire in halves as shown in the illustration. Unless the tire is badly worn and punctured, either or both halves may be used. Place them on the ground in your chicken-yard and keep them filled with water. Even heavy chickens cannot upset this trough and their feet cannot be injured by the rubber as they sometimes are by tin pans or basins.—WILLIAM F. PAYNE.



Half an old tire forms a water-trough for chickens

Try this Handkerchief Trick at Home

HERE is a pretty silk-handkerchief trick that any one can do. Two silk handkerchiefs are shown and passed for examination, if so desired. Then they are both taken in one hand and tossed in the air. They fall down knotted together.

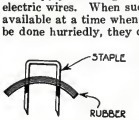
The "key" to this simple bit of conjuring is a thin rubber band, such as is used in flower shops or a small band of any kind painted white. The band is slipped over the first finger and thumb, the ends of both handkerchiefs are allowed to be banded while the throwing motion is going on. The appearance is of two handkerchiefs knotted together.

The trick puzzles onlookers and even an ordinary rubber elastic cannot be detected. No one thinks of looking for such a thing. It should not be presented as a separate item, but mixed in with other parlor tricks it answers its purpose. —MERRITT HALE.

Surprise your friends with this simple trick

If You Have No Insulating Staples, Make Them

NOT every household is equipped with a supply of wiring staples for insulating electric wires. When such staples are unavailable at a time when some wiring is to be done hurriedly, they can be improvised by using double-pointed carpet-tacks with pieces of old inner tube, about ¾ in. square, as insulators. The illustration clearly explains how it is done.



Pieces of inner tube insulating electric wires

Linoleum Blocks Used in Cloth Printing

BLOCKS for printing conventional patterns on table-covers, napkins, and other textile fabrics for the purpose of ornamentation may be made from heavy linoleum which is extensively used as floor-covering. All that is required is a smooth piece of linoleum, a sharp knife, indelible inks, and a certain skill in drawing.

If you have artistic talent, invent and draw your own designs. If you are not so gifted, borrow or copy a design from books, magazines, or illustrated art works. Draw or copy the design on paper and transfer it reversed on the linoleum by tracing it through carbon paper. The outlines should be drawn sharply and in ink. Then, with a sharp knife cut through the linoleum along the black lines and remove the pieces that represent the white parts not showing in the print. The linoleum is then mounted on a block of wood with small nails, inked with a wad of cotton, and pressed on the cloth in the proper place and position.

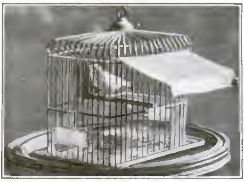
Ornamental designs may be printed on cloth by patterns cut from linoleum and tacked to wood blocks

With a little artistic skill very attractive combination patterns for borders, centers, or corners may be produced.

An Awning for the Canary's Cage

CANARIES do not like to be in the sun and invariably seek the shadiest part of their cage.

To provide an awning for the bird, take a few strips of stout wire or banded brass, bend them to the desired shape with a pair of pliers, and provide a few cross pieces for support. Cover the frame so made with a suitable covering and the shade is complete. For convenience, the upper part of the frame is provided with a small hook made by bending the extreme ends of the wires in the proper shape so that they will fit easily over the upper horizontal wires of the cage. Then the shade can be removed when it is not needed.—E. BADE.



Do you wish to give comfort to your pet canary? Make one of these awnings for him

Statement of the Ownership, Management, Circulation, etc., required by the Act of Congress of August 24, 1912, of Popular Science Monthly, published monthly at New York, N. Y., for October 1, 1921. State of New York, County of New York, ss. Before me, a notary public, in and for the State and county aforesaid, personally appeared O. B. Capen, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Popular Science Monthly and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Modern Publishing Company, Inc., 225 West Thirty-ninth Street, New York, N. Y. Editor, Waldemar Kaempffert, 225 West Thirty-ninth Street, New York, N. Y. Managing Editor, Waldemar Kaempffert, 225 West Thirty-ninth Street, New York, N. Y. Business Manager, O. B. Capen, 225 West Thirty-ninth Street, New York, N. Y. 2.—That the owners are: The Popular Science Publishing Company, Inc., 225 West Thirty-ninth Street, New York, N. Y. Stockholders of Popular Science Publishing Company, Inc., Henry J. Fisher, 22 William Street, New York, N. Y.; Oliver B. Capen, 225 West Thirty-ninth Street, New York, N. Y.; Robert Cade Wilson, 683 Springfield Avenue, Summit, N. J.; Waldemar Kaempffert, 225 West Thirty-ninth Street, New York, N. Y.; George B. Agnew, 22 William Street, New York, N. Y.; Susan D. Bliss, 22 William Street, New York, N. Y. 3.—That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: Importers and Traders National Bank, 247 Broadway, New York, N. Y.; H. J. Fisher, 22 William Street, New York, N. Y 4.—That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) O. B. CAPEN, *Business Manager.*

Sworn to and subscribed before me this 21st day of March, 1921.

Arthur A. Blauvelt, Queens County—2767, New York County—639, New York Reg. 1612.

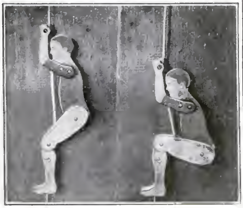
(Seal.) My commission expires March 30, 1921.

The Rope-Climber—an Interesting Toy

THIS cord-climber is similar to the climbing monkey, only he goes by lifts instead of a constant run, and he hasn't learned how to climb down by himself. The cord is suspended from a nail or hook, and when the cord below the model is pulled, he stretches himself, measuring about 2 in. at a pull. This operation is repeated until he reaches the top, when he must be forcibly pulled down the string by hand.

The figure at the bottom of the page shows the detail and dimensions of the body portion. There is a spring-steel backbone to this figure that is used to throw the legs forward and upward after being released from the downward pull on the cord.

A sawcut is made in the back of the body portion in such manner as to just miss the head, and extends well around the curve at the lower part of the body, as shown by dotted line in Fig. 1. It is well to use a saw that makes a wide cut so as to



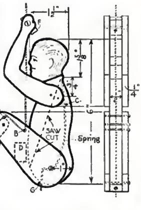
At the left the rope-climber is shown with the string taut; at the right, with the string loose

allow room for the movement of the spring. Smooth the inside of the cut with a folded piece of medium coarse sandpaper.

For the spring a good grade of steel wire, 1/16 in. in diameter and not tempered beyond cold bending, should be used. The wire is bent as shown in the diagram.

The two leg pieces from hip to knee have a semicircle at each end, the knee being the more important, as the lower leg is to revolve about this. The radius at the

Here the detail of the construction of the figure is shown. The backbone is formed by the motion - giving wire spring



knee is ½ in. and the joint-pin is in the center of the semicircle, but at the hip the joint pin is about 3/16 in. above and to the right of the center of the semicircle. The location of the leg pin in the body piece is in the center of the semicircle at the lower end of the body.

It is well to fasten a little block some-

where between the legs, Fig. *D*, to give more rigidity, and to make them move as one.

The lower part of the leg is attached to the upper by means of a thin sheet-metal insert.

Each arm is in one piece, has no movement at all, and no joint at shoulder or elbow. A small block, Fig. 1*E*, with a hole, through which the cord passes, is fastened between the feet. Another block *F*, is secured between the hands. A screw passes through one hand and block, but it is threaded to the opposite hand, which makes a clamp of the device.

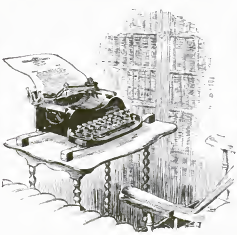
The block is sawn apart and little grooves are cut in both sides to receive the cord. The crease must not be large enough to prevent the clamping of the cord or it will be useless. The clamping causes friction on the cord that prevents the climber from slipping backward. A twenty-four-ply seine twine is excellent for the cord. If the crease wears, a turn of the screw will tighten the clamp.

A pin, Fig. 1*G*, is necessary to catch the end of the spring when the leg is drawn down while climbing.

When the toy is operated, the extension draws the string down through the clamp, *F*. Then the legs are released and spring back. The spring holds them until the slack is taken up in the string and the figure is straightened again.

Hanging the Typewriter in a Swing

A TYPEWRITER that is used in the home or boarding-house should be as silent as possible in order not to disturb others. Recognizing this, the writer, who lives under the handicaps imposed by a



When suspended in this manner between little blocks of wood your typewriter will not disturb your neighbors

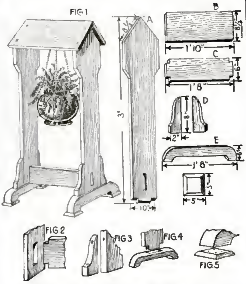
boarding-house, tried out the various rubber and felt pads on the market but found they only lessened the noise to a slight degree. So, under the spur of necessity, he devised a simple contrivance that answered the same purpose much better.

The construction is simple in the extreme. The table is small with a top about 15 in. square. Four wooden blocks about 1 in. high are nailed to the table as illustrated. Over these blocks strips of heavy flannel are spread and drawn taut and then tacked to the blocks. Care should be taken to have the feet of the typewriter resting in the center of the strips of flannel. You will find that the carriage of the typewriter can be moved back and forth without in any way disturbing the machine.—H. Fowler Goodwin.

A Support for a Hanging Fern-Basket

CLEARLY shown in the accompanying drawing are the construction and use of this hanging-basket support. It is suitable for a sunny corner of the house in the wintertime and may be used on the porch or lawn in the summertime.

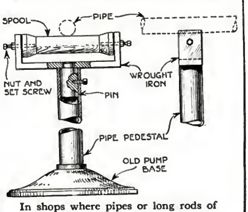
Because of its natural beauty and comparative inexpensiveness, yellow pine is the best material to use. First shape out the sides *A* and the rail *C*, and fasten them together with glue and concealed nails. The base bridges with their blocks are next made and screwed together. The diagram shows how the upright pieces and base are joined. The three-cornered blocks *D* are screwed to the lowest part of the edges of the uprights, as in Fig. 3. For finish, fill with shellac or varnish and stain light mottled green or weathered oak. This is followed by two coats of wax or varnish rubbed dull.—H. ADLON.



With little trouble you may make one of these supports for a hanging basket

Describing a Movable and Revolving Pipe-Rest

SOME days ago, while in a machine-shop, I noticed a pipe-rest, evidently made in the shop, for supporting pipe while the pipe was being cut in a machine using a saw-blade (working horizontally) as a cutter. As the rest was not attached to the floor, it could be placed at a distance to accommodate various lengths of pipe. The spool had previously been turned in a lathe.—JAMES M. KANE.



In shops where pipes or long rods of metal are frequently handled, the pipe-rest here shown will be very useful

How to Keep Chickens in Their Yard

CHICKENS can be kept in their pen by nailing two-foot slats at an angle to the posts and stringing a number of strands of thin wire through them as shown in the drawing. The chickens do not see

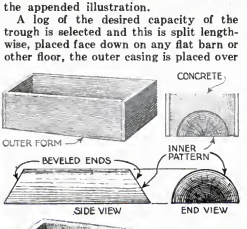
Wires stretched as shown here will effectively prevent chickens from wandering into the neighbors' yards

these wires and when they attempt to fly over the fence, they strike the wires and fall back into their yard. After a number of futile attempts, they will not try to fly over again.—E. BADE.

A Form for Molding a Concrete Trough

A FOOD trough for pigs is readily made from concrete, using for a form a semicircular section of log and rectangular box made with nailed planks as shown in the appended illustration.

A log of the desired capacity of the trough is selected and this is split lengthwise, placed face down on any flat barn or other floor, the outer casing is placed over



One half of a beveled log and a wooden frame is all that is required for casting a concrete trough

this and secured with two nails to prevent it from shifting while the cement is poured.

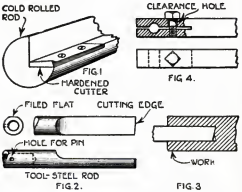
A coat of axle grease is smeared over the surfaces of the wood to prevent the concrete from sticking. After pouring, the cement it is allowed to set for several days. This makes a trough that is practically indestructible and is not readily upset. Similarly, troughs for cattle, chickens, etc., may be made of any desired size.—G. A. LUERS.

Drills for Boring Deep Holes in Metal

WHEN the amateur mechanic has an extra deep hole to drill in metal that is beyond the capacity of an ordinary drill, he is at a loss just how to proceed. Few mechanics know that they can make a drill for this work very easily. The drills mentioned in this article will drill holes of small diameter to a depth of 10 in. with perfect accuracy, providing they are used only on a lathe.

For holes of large diameter, ½ in. or more, the type of special drill shown in Fig. 1 will be found satisfactory. The cold-rolled rod upon which the cutting edge is mounted should be about 4 in. longer than the hole to be drilled. One quarter of the rod is then cut away as illustrated. This will have to be done in a machine-shop if a shaper is not at hand. Exactly one quarter of the rod should be cut away. A cutter of the shape shown is then cut from tool steel. This is ground true and the cutting lip sharpened. The piece is then hardened. Before the hardening, two holes should be drilled for the holding-down screws, which should be countersunk.

A recess is cut in the cold-rolled rod so that the cutter will come flush with the surface. The cutting edge is ground at a slight angle so that it will gradually incline outward from the center. When using this



Several types of special drills for boring deep holes are here shown. Learn how to make them in your own shop

type of drill, it is best to start the hole with an ordinary drill.

A simpler type of deep drill is illustrated in Fig. 2. This is used for small holes and will be found very efficient and easy to make. The cutter is made from a short length of tool-steel rod. This material is commonly called drill rod. The rod should be the same size as the hole that is to be drilled. The length of the rod should be from 4 to 6 in., depending upon the size. Exactly half of it, for a distance of 2 in., is filed away and a slight angle is filed on the front of the cutting edge. Considerable care must be exercised in this filing so that a perfectly flat surface is produced. Care should also be taken that exactly half the material is filed away, as this influences the size of the hole. The piece is now put in a lathe and drilled out for a distance of 3 in. This hole is to receive a cold-rolled rod upon which the cutter is mounted. One, or possibly two holes, should be drilled through the center of the rod and pins inserted. This will prevent the cutter from turning while the device is in use. A slight flat should be filed along the top of the cutter to allow the chips to find their way out. The shank of the tool should be tapered off about .002 in. When all this

work is finished, the center should he hardened and tempered. It is then ready for work. Its action is shown in Fig. 3.

When the D-hit is used in a lathe, a special handle must he made to accommodate it. Such a handle is shown in Fig. 4. It should fit in the tool-post of the lathe. A piece of cold-rolled flat stock is used. About 6 in. of this will suffice and one end is slotted for 2 in. with a hacksaw. Before the slot is cut, a hole is drilled to accommodate the drill. Care should he taken that this hole is perfectly accurate. When the sawing is done, another hole is drilled through to accommodate the clamping-nut. One half of this hole is drilled out to make a clearance for the holt. When the bolt is tightened, it will pull the holder together and hold the rod tightly.

When the tool is used, the hack center of the lathe should be brought in contact with the free end of the drill. This type of tool is very slow in its cutting and should not he forced too much. Lubricating oil or cutting compound should he applied liberally and the tool should he withdrawn at regular intervals to hring out the chips.

An Extra Chuck to Hold Small Drills

AN extra chuck for small drills to he used in an ordinary carpenter's brace can he made as follows:

Procure a piece of good tool-steel about 5/16 in. in diameter and 2 in. long. Drill ⅛-in. hole lengthwise through the center of the piece. Then, with a hacksaw, cut a slot down the center to within ½ in. of the end, as shown in the illustration.

This chuck is useful for holding drills

This chuck can be used in a carpenter's brace or any other form of chuck and, owing to the spring of the slotted ends, it will grip various sizes of drills.

How to Enclose Stamps in a Letter

NEVER stick a stamp to a letter. There are at least three better ways. If you are enclosing one stamp in a letter, make two slits ½ in. long and ¾ in. apart, then slip diagonally opposite corners of the stamp in the slits. If there are two stamps or more to be enclosed, make two slits 1 in. long and about 1 in. apart and run the string of stamps through.

Two methods of enclosing stamps

When stamps with the adhering margin can he obtained, leave the perforated margin on and stick it down on the paper so that the stamp can be torn off.

The very hest way to enclose a stamp for reply is to put it on a self-addressed envelope. Another way to enclose stamps is in the small drug envelopes commonly used to contain small articles.

A Real Tin Lizzie Made from Cans

WITH an assortment of tin cans to work with the writer made a tin can automobile that is very good looking.

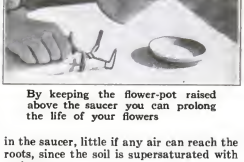
The hood is made of ahout three quarters of a large condensed-milk can, one end being left in for the front of the car. The seat is made of part of the remainder of the

Whatever is lacking in the resemblance of this toy to a real car will be supplied by imagination

large milk-can. Behind the seat is the gasoline tank, represented hy a coffee-can and lid. Each wheel is made of two sizes of lids, one fitting into the other to give solidity. One lid is a coffee-can lid and the other a haking-powder-can lid. Screwed to the wooden axle these lids are strong enough to serve their purpose. Even the steering-wheel is a lid with openings cut to form the spokes.—CHARLES A. GODDARD.

Prolong the Life of the Window-Garden

DON'T keep the flower-pot standing in water; it is injurious to the plant and especially to the root system. The moisture, when the plants are watered, should run through the root balls as quickly as possible. The roots not only require moisture, but also air, and if the saucer is full of water, and if the pot stands directly



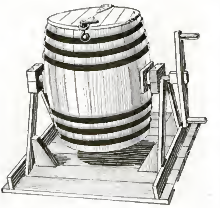
By keeping the flower-pot raised above the saucer you can prolong the life of your flowers

in the saucer, little if any air can reach the roots, since the soil is supersaturated with moisture.

Therefore it is desirahle to keep the flower-pot slightly above the saucer. This is accomplished by taking two pieces of band iron ahout ¼ in. wide and 1/32 in. thick and iron 8 to 10 in. long. These are bent with a flat-nosed pair of pliers in the desired shape so that it fits snugly around the pot and at the same time lifts the pot ahove the saucer, as shown in the illustration. These two pieces are bent exactly similar to each other, then they are crossed, and finally held in place hy two U-shaped clips bent firmly around the center of the cross piece.—E. BADE.

Mix Concrete by Means of a Tumbling Barrel

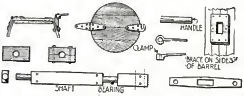
A LABOR-SAVING concrete mixer that can be improvised from materials normally procurable without cost, is shown in the illustration. It consists of a tumbling barrel in which half-bag batches can be



For mixing concrete in small quantities this tumbling barrel will be found very useful

rapidly and thoroughly mixed with the least effort and provides a means of emptying the concrete directly into the barrow without additional shoveling.

The barrel is mounted on a center pivot with brace-blocks at the sides to secure this shaft member to the barrel. The barrel head is hinged at one side and a circular block made to stiffen the lid and to provide a closer-fitting cover. A quick-acting clamp is fitted at the opposite side from the hinge. The lower side of the barrel is mounted about 2 ft. above the platform, to permit of rolling the barrow



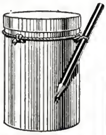
The various parts of the rocking mechanism, excepting the barrel and framework

underneath for dumping. Oak blocks bolted to side braces form the mounting for the center bar. The platform underneath is of close-fitting boards to permit of shoveling where the sand, gravel, cement, or concrete is unavoidably spilled. The shaft extending through the center of the barrel assists in cutting and mixing the batch, as the barrel is oscillated.

An Easy Way to Remove a Tight Can-Lid

CAN-LIDS are often difficult to remove. Here is a plan by means of which they can be loosened easily.

Tie a piece of stout twine loosely just below the cover, then thrust under the twine a pencil and start to twist this. When the twine is tight, the cover of the can comes away readily.



Twist string with pencil to remove the lid

Finding New Uses for Old Things

What use have you for some of the "junk" in the attic or cellar? Popular Science Monthly will pay ninety dollars for the best answers

THERE is the old baby-carriage, the old stove, the old bureau, the trunk, and the leaky wash-boiler. The attic also contains old phonograph needles, safety-razor blades, carpets, curtains, chairs, tables, picture-frames, hat-boxes, etc. Have you been able to save money and add a convenience to your home by pressing some of these things into service again? If you have, you probably had to get the household tool-kit out to help you. Sit right down now and tell Popular Science Monthly what changes you made and how you made them. It makes no difference what you changed, as long as it was old. You may win one of the prizes.

The Popular Science Monthly offers three prizes for the best answers—a first prize of $50, a second of $25, and a third of $15. These will be awarded in accordance with the rules outlined below.

Rules Governing the Contest

(1) Contestants are not limited to the number of ideas, but only one method can possibly win the first prize, only one the second, and only one the third. The contest is open to everybody.

(2) The use of the old piece of junk must be shown clearly, either in a photograph or in a drawing. If a drawing is sent in, it need not be made by a skilled draftsman. It is sufficient that it should be intelligible. While pencil sketches will be considered, contestants are requested to make their drawings in ink on heavy white paper. The views should be sufficient in number to set forth the writer's idea very clearly. The contestant's name and address should appear on each sheet of drawings.

(3) The drawings or photographs must be accompanied by a description, preferably typewritten, in which the method is clearly given. It must be written on one side of the paper only, and it should not be more than 500 words in length. The name and address of the contestant should appear in the upper left-hand corner of the first sheet of the written description.

(4) The drawings and description entered by contestants must be received by the Popular Science Monthly not later than 5 p. m., on June 15, 1921.

(5) The judges of the contest will be the editors of the Popular Science Monthly.

(6) The first prize of $50 will be awarded to the contestant who, in the opinion of the judges, has suggested the best use for an old piece of junk.

The second prize of $25 will be paid to the contestant who submits an idea next in merit.

The third prize of $15 will be paid to the contestant who submits an idea third in merit.

(7) The winners of the contest will be announced in the earliest possible issue of the Popular Science Monthly. A description of the ideas that win the three prizes offered will duly appear in the pages of the Popular Science Monthly, together with the names of the winners.

(8) The editors of the Popular Science Monthly shall have the right to publish meritorious manuscripts that do not win a prize. The regular space rates will be paid to the contestants who submit the manuscripts thus selected.

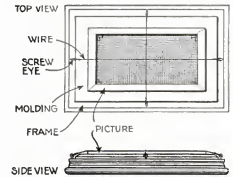
(9) When a contestant submits more than one idea, the description and drawing by which each is set forth must be sent as a separate unit.

(10) Manuscripts or drawings will be returned to contestants if stamps are enclosed.

(11) Send drawings and specifications to the Editor of the New Uses for Old Things Contest, Popular Science Monthly, 225 West 39th Street, New York City.

No Nails or Screws in This Frame

PAINTINGS mounted on stretchers have to be framed for exhibition purposes. It is not always feasible to provide frames and mats for each painting. The same frame and mat may have to serve for many pictures of corresponding size. In such cases it is not desirable to fasten the



How a painting may be temporarily framed without the use of nails or glue

canvas in the frame permanently with nails, screws, or glue. The difficulty can easily be overcome by screwing screw-eyes in the middle of each side of the frame, placing the mat and picture in position and stretching wires from one screw-eye to the other on the opposite side, forming a wire cross that will hold the three parts of the picture firmly together.

Any slackness of the wires may be remedied by giving a slight turn to the screw-eyes to which the wire is attached.

Perforating the Bottle Cap Aids in Pouring

A VERY easy way to pour milk from a full bottle is as follows: Near one edge of the paper cap cut a V-shaped opening with a knife, and near the opposite edge cut an X-shaped opening. By lifting up the point of the V, and the four

Fluid may be poured from a bottle without spilling, if the cover is provided with the openings indicated

points of the X, milk can be poured in an even, steady stream from the bottle. The milk should come through the V opening; air is admitted to the bottle through the X cut. The cream may be mixed with the milk before punching the openings by shaking the bottle.—FREDERICK C. DAVIS.

This Wagon Is Moved by Oars

By Frank W. Vroom

Your boy will be delighted with one of these rowboat wagons and will be benefited by exercising with it

THE wagon herein described is a vehicle that combines the features of a rowboat with those of a cart and, if properly made, will be a great muscle developer as well as a source of amusement.

The working parts are such as to require careful construction.

First, procure enough ash or other springy wood to construct the framework of 1½ in. by 2 in. stock. Following are the dimensions: Width across front, 4 ft.; width across rear, 6 in.; cross piece for oars, 20 in.; 2 pieces of gaspipe, each 10 in.; 2 pieces of stays, 14 in.; rest for feet—for steering, 12 in.; center piece (lengthwise), 50 in.; pieces each side of center—front to seat—20 or 21 in.; seat to rear—12 in.; cross piece under seat, 7 in.

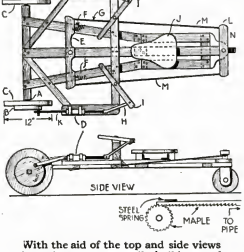
The remainder of material needed is as follows: two pieces of oak or maple, 8 in. square; if turned separately, 1-in. stock will do, but if the large wheel and the pulley are turned in one, 1½ in. will be necessary.

Piece of hard wood for seat 1 in. by 6 in. by 8 in., shaped to conform to drawing.

Two curved pieces on rear 1½ in. by 2 in. by 8 in., shaped as shown.

One piece for tiller or steering-arm, 1½ in. by 1 in. by 8 in.; two pieces for oars, 1 in. by 1 in. by 12 in.; 1 piece of ½-in. round iron, 24 in. long.; 1 piece of ¼-in.—inside diameter—gaspipe 6 in. long. Keep this well oiled on inside. Two 1-in. coil springs, 3 in. each. Bolts for pivoting foot-rest, oars, and tiller. Small stove bolts for joining arms on oars and pulleys to iron in pipe. Screws—flat head—2 in. long, No. 10 wire. Wood strips for joining oars and pulleys.

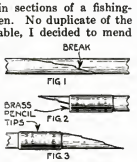
By referring to the drawings the construction of the vehicle will become clear. *A* is the front axle of square iron, 1 in. by 50 in. Thread the ends to receive the nuts countersunk in the pulleys. *B* is the pulley, turned on big wheel or separately. *C* is the large wheel for traction. It should be rimmed with strap iron. *D* is a gaspipe, fastened to the frame with iron straps as shown. *E* is the footboard, with foot-rests cut as shown. *F* are the springs for holding the rear wheel to its course when going straight ahead. *H* is an arm of wood to fasten the oar to the main shaft. *I* is the oar; if greater leverage is preferred than that specified, these may be made longer and pivoted nearer the end of the frame. *J* is the seat. *K* is an arm of wood connecting the pulley with the shaft. *L* is the tiller for steering the vehicle. *M* is the wire cable, connecting the tiller with the foot-rest. *N* is the rear wheel, 7 in. in diameter and should be set into the projection of the center piece of the frame and in a fork of wood similar to the front fork of a bicycle.



With the aid of the top and side views here given you can easily build one of these rowboat wagons

Pencil-Tips for Splicing a Fishing-Rod

ONE of the thin sections of a fishing-rod was broken. No duplicate of the part being obtainable, I decided to mend the break. I cut off the rubber-holding brass tip of two lead-pencils, of which one was slightly smaller than the other, and removed the wood and lead in them. I forced the larger of the tips on the thicker part of the broken section and the smaller tip on the thinner section, as shown in the illustration. Then I shellacked the surface of the break and pressed the two parts together. The two metal tips clamped the cemented parts together, holding them in place and strengthening what would otherwise have been a weak spot. The repaired section of the rod was coated with shellac to prevent the tips' slipping.—J. M. KANE.



Brass tips of pencils hold together the parts of the broken rod

How to Bend Brass and Copper Tubing

WHEN small tubes of brass or copper or steel are to be bent, they have a tendency to flatten out at the curve. Small tubes can be bent without flattening if they are first filled with molten resin. Larger tubes may be filled with sand. If resin is used, the tube is heated again after bending and the resin is blown out with a bicycle- or automobile-tire pump.—L. LAURIER.

A Rustic Typewriter Table for the Porch

FOR this table the frame is made from yellow birch poles that may be cut in the woods and are from 1 in. to 2 in. thick.

The photographs show the completed typewriter table, both rear and front views. Each leg was 24 in. long, casters raising it to 27 in., allowing 1 in. for the thickness of the top boards.

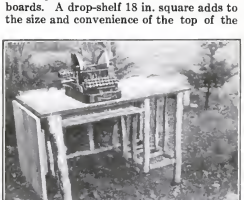
The length of the cross sticks of the table forming the ends was 16 in. The length of the rear sticks was 30 in. To hold the top of the legs firmly together three sticks of pine lumber were used; the two at the ends being 16 in. long, while the rear stick was 30 in. The width of this lumber was 2 in.

If you use your typewriter in rustic surroundings, it should rest on a rustic table

and these sticks come just under the table-top, where they are not seen, giving the table greater strength than round sticks.

The shelf for the typewriter paper was 20 in. wide and the book compartment at the right of the table was 8 in. wide by 20 in. deep. This compartment was made to accommodate letter files, books, etc. The narrow shelf directly under the machine is for holding two piles of typewriter paper of the standard size.

The top of the table was made from two 9-in. oak boards cut 3 ft. long and secured in place by screws extending through the frame poles into the under side of the boards. A drop-shelf 18 in. square adds to the size and convenience of the top of the



Here the front view of the rustic typewriter-stand is given, showing the paper drawer and the bookshelf

typewriter table. The boards were finished with oak stain varnish, after having been properly filled. Boards were used for the bottom of the narrow shelf and poles for the base of the compartment at the right for books and files.

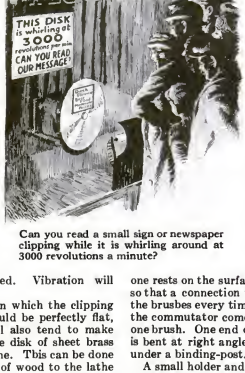
The drop-leaf was attached by means of three brass hinges and held supported for use by means of a forked pole of birch cut just the right length to hold the leaf level with the table-top.—F. E. BRIMMER.

Attract Customers by This Electrical Trick

By **L. A. Laurier**

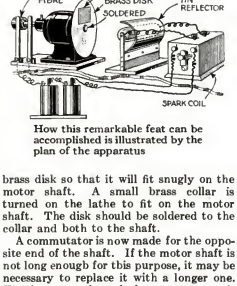
THE apparatus here described makes it possible to read a newspaper clipping whirling around on a disk making 3000 r.p.m. When assembled, the device may be put in a show-window as an advertising attraction.

A good smooth-running battery-motor or a 110-volt fractional horsepower motor may be used. The bearings on the motor used should be in perfect condition so that they will not vibrate excessively when the machine is running at high speed. Vibration will spoil the illusion.



Can you read a small sign or newspaper clipping while it is whirling around at 3000 revolutions a minute?

The brass disk upon which the clipping is to be mounted should be perfectly flat, as a wobbly disk will also tend to make reading difficult. The disk of sheet brass should be cut on a lathe. This can be done by attaching a block of wood to the lathe faceplate. Four screws are then used to hold the sheet brass to the wooden block. When the lathe tool is brought in contact with the sheet metal while the lathe is in operation, a nice clean-cut true disk can be obtained. A central hole is drilled in the



How this remarkable feat can be accomplished is illustrated by the plan of the apparatus

brass disk so that it will fit snugly on the motor shaft. A small brass collar is turned on the lathe to fit on the motor shaft. The disk should be soldered to the collar and both to the shaft.

A commutator is now made for the opposite end of the shaft. If the motor shaft is not long enough for this purpose, it may be necessary to replace it with a longer one. The brass portion of the commutator is made first. This is shown in the detail drawing. First a brass bushing about ½ in. long is cut. This should be about ⅜ in. in diameter. A slot is cut lengthwise in this with a hacksaw, and a brass strip is then inserted and soldered in this slot. A hole is then drilled through the center of the bushing so that it will fit on the motor shaft snugly. Just a slight driving fit should be produced.

A piece of fiber is now placed in the lathe and turned down to a diameter that corresponds with the distance between the top of the brass strip and the center of the brass bushing. The center of the fiber bushing is now drilled out with a ¾-in. drill. A slot is now cut lengthwise in the brass bushing as shown. This will permit the fiber bushing to slide over the brass piece. When this is done, the top of the little brass strip previously soldered in the brass bushing should come flush with the outer surface of the fiber bushing.

Two copper brushes are now made as shown. One of these brushes makes contact with the motor shaft and one rests on the surface of the commutator so that a connection will be made between the brushes every time the brass portion of the commutator comes in contact with the one brush. One end of each of the brushes is bent at right angles and each is placed under a binding-post.

A small holder and reflector is now made for a Geissler tube. The Geissler tube should be of the plain kind with no fluorescent liquids in it. The plain type gives more illumination than the fluorescent type.

The Geissler-tube holder is supported between two little spring brass pieces attached to an upright board. Mounted behind the Geissler tube is a small semicircular piece of bright tin or aluminum or any bright metal that will act as a reflector.

With the addition of a small spark-coil (about ½ in. sparking capacity), the little apparatus is ready to be put together. The connections are shown. It will be seen that every time the brass piece comes in contact with the copper brush, the circuit will be closed and the primary of the spark-coil will become excited, causing the Geissler tube to become luminous. The light from the Geissler tube will be reflected on the brass disk carrying the clipping.

The brass contact piece on the commutator is so arranged that the circuit will be completed only when the clipping on the brass disk is in an upright position. If the speed of the motor is 3000 r.p.m., the circuit will be made and broken that many times every minute. It will be seen, however, that the disk will only be illuminated when the paper is in a certain position. Thus the newspaper clipping on the disk will appear stationary and the clipping can be read with the greatest ease while the wheel is traveling at this high rate of speed. If the brass disk travels smoothly and does not wobble, and if the bearings of the motor are in good condition, a perfect illusion will result.

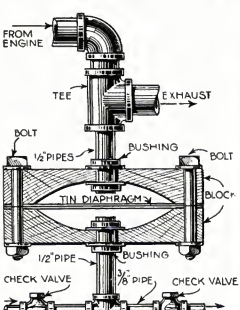
The Geissler tube in greater detail

Cooling-Water Pump for Stationary Engines

THIS automatic pump is operated in connection with the exhaust of a gasoline engine and is used as pump for cooling water circulation or, in a boat, for pumping out the bilge-water.

As can be seen from the drawing, two blocks of wood are hollowed out to a depth of 2 in. and about 10 in. in diameter. A hole should be bored in the center of each block to take a ½-in. pipe tightly. Fit in a piece of this pipe in each block and fasten with pipe bushings on each side of the wood with a sheet of rubber packing under each, so as to make an air- and water-tight fit.

Take a smooth thin sheet of new flat tin and clamp it smoothly between the two blocks, using rubber or asbestos gaskets. Bolts are passed through holes to clamp the whole together. Connect the top side of the pump with a reducing tee in the exhaust line and close up to the same and in a horizontal position as shown. The lower side of the pump is connected with the side outlet of a tee in a ⅜-in. pipe-line. Place two check-valves horizontally and



Alternating pressure and suction in the exhaust line will cause the tin diaphragm to vibrate in unison with the explosions

one on each side of the tee, as indicated in the drawing; one is the suction and the other the discharge valve.

The pressure and suction in the exhaust line between and during explosions will cause the diaphragm in the pump to vibrate in unison with the explosions in the engine, causing expansion and compression in the lower chamber of the pump. The changes in pressure cause the valves to open and close, thus drawing in and discharging water. It will be found necessary to fill the parts with water before operating, unless used in connection with a powerful impulse motor.—B. FRANCIS DASHIELL.

Keep the Hungry Moth Away

A SMALL bag of cedar shavings or a few cedar-wood blocks placed in the bottom of a trunk in which clothes are kept, or placed in a clothes-closet, will keep out the moths and thus prevent the clothes from being moth-eaten. It will not fill the clothes with a disagreeable odor as moth-balls do.—G. H. GLITZKE.

Learn the Auto and Tractor Business In Detroit the Auto Center

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There are many advantages in coming to Detroit during the summer season. You can visit the world's greatest automobile factories during the long summer evenings; you can visit Detroit's many beautiful parks, or take a boat trip on the Detroit River or Lake Erie; boats leave Detroit wharfs every few minutes.

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